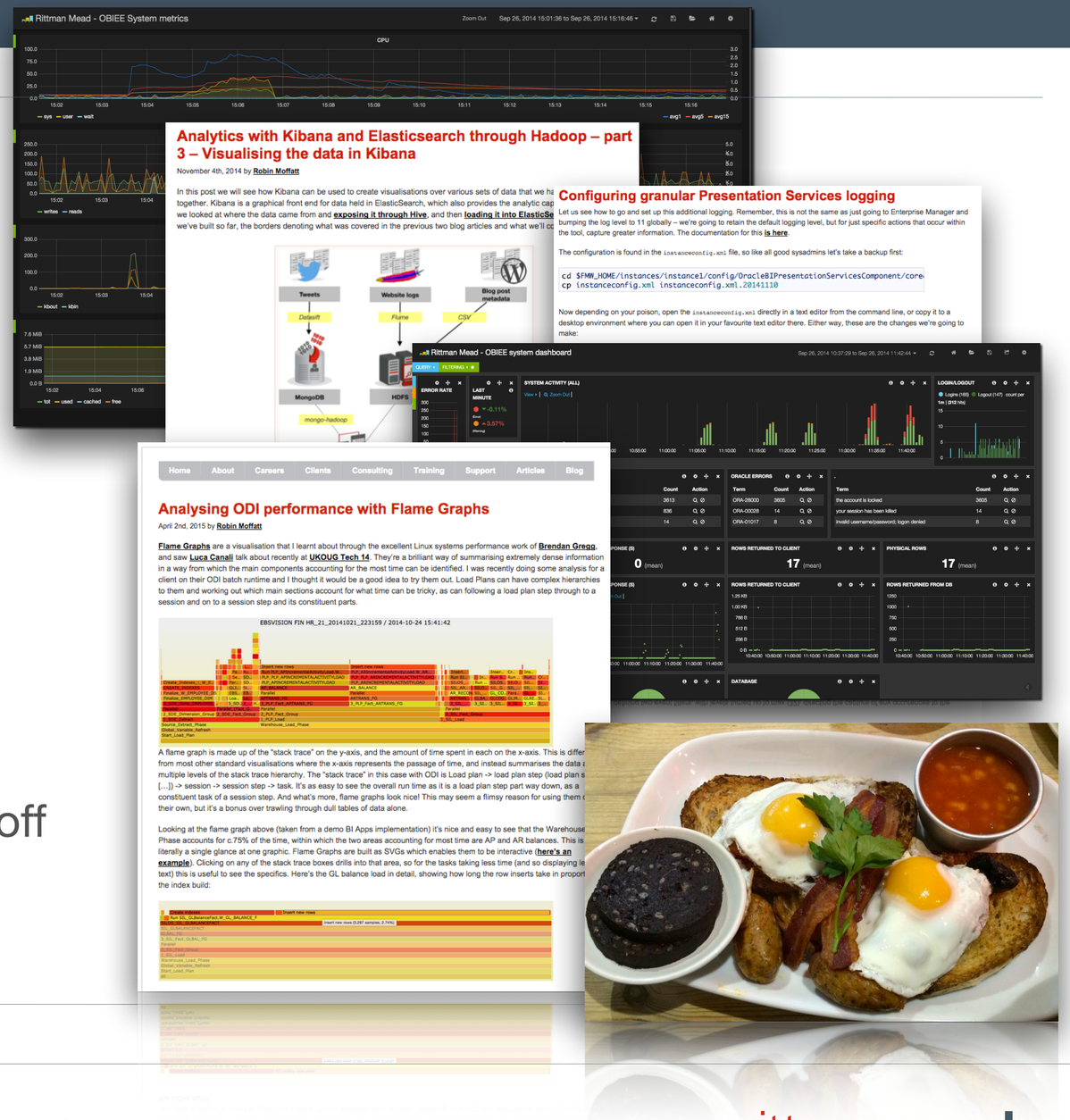
Smarter Regression Testing for OBIEE

Robin Moffatt, Principal Consultant, Rittman Mead | December 2015

About Me

- Principal Consultant with Rittman Mead
  - OBIEE & ODI
  - SysAdmin
  - Performance
- Previously …
  - OBIEE/DW developer at large UK retailer
  - SQL Server DBA, Business Objects, DB2, COBOL….
- Oracle ACE



- Frequent blogger for Rittman Mead : http://ritt.md/rmoff
- Twitter: @rmoff
- IRC: rmoff / #obihackers / freenode

About Rittman Mead

Optimizing your investment in Oracle Business Analytics

- World's leading specialist partner for technical excellence, solutions delivery and innovation in Oracle Data Integration, Business Intelligence, Analytics and Big Data
- 70+ consultants worldwide including 1 Oracle ACE Director and 2 Oracle ACEs
- Providing our customers targeted expertise; we are a company that doesn't try to do everything… only what we excel at
- Founded on the values of collaboration, learning, integrity and getting things done
- Comprehensive service portfolio designed to support the full lifecycle of any analytics solution

Regression Testing

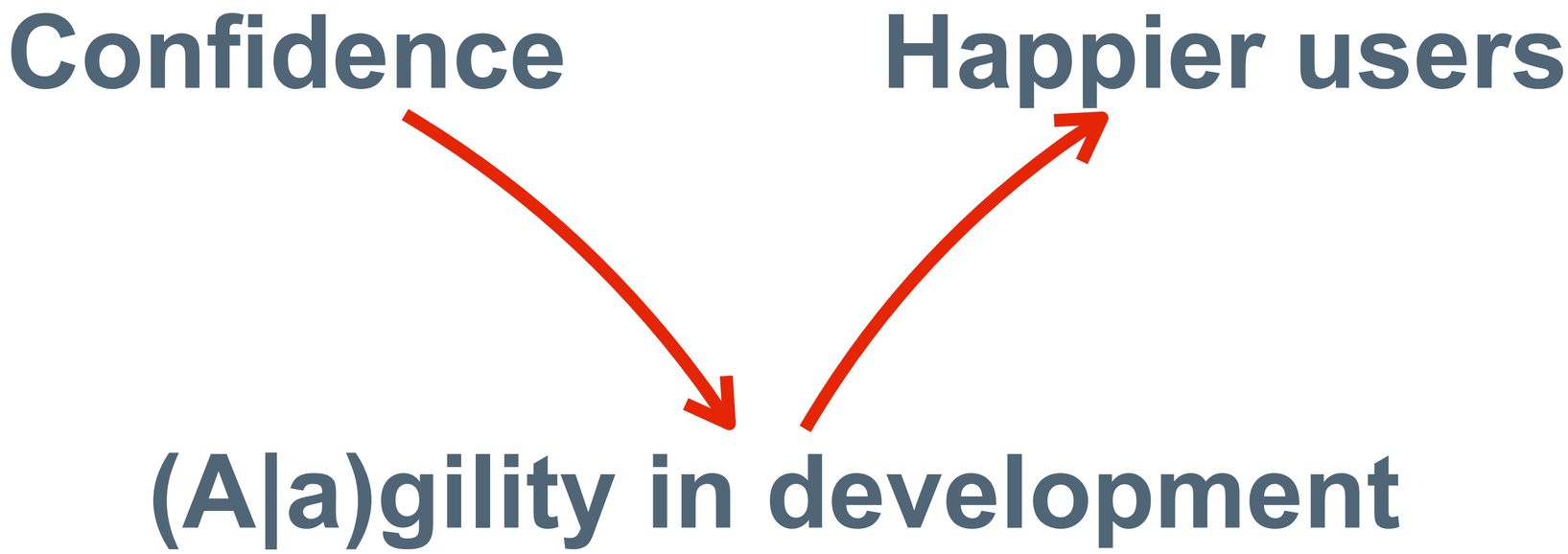
- **Why**
- **How**
  - including BVT!

Better OBIEE development delivered more rapidly and with greater quality

Why Regression Test?

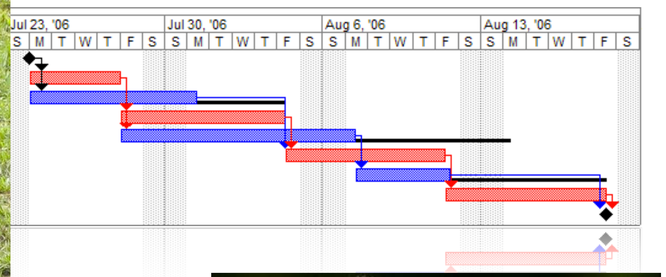
Confidence

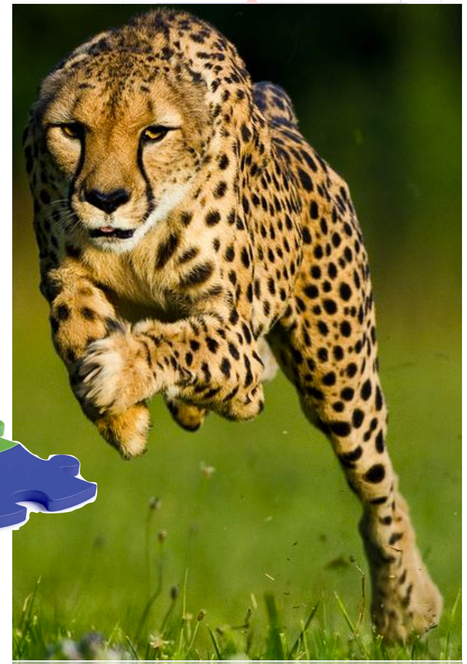
Why?



What?

- Regression Testing is not just a prolonged exercise on a Gantt chart, just before go live

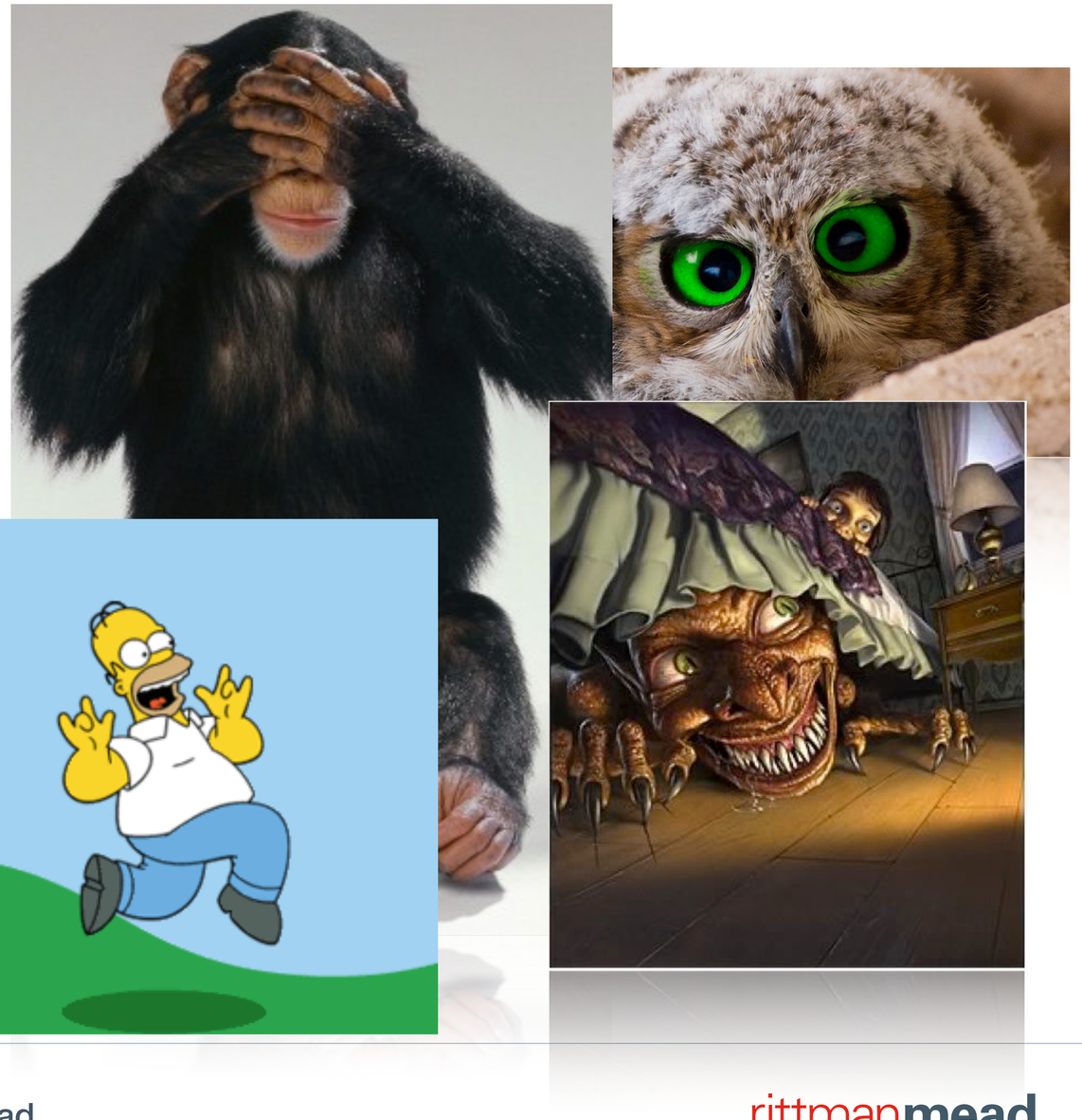




- Smart Regression Testing is be run on demand, targeting the change made and assuring quality during development

Detect Problems Early

- Fresh in the developer's mind
  - **Easier to fix**
- Fewer surprises during big test cycles
  - **More honest & realistic project status reports**
- Better overall QA for the system
  - **Happier users**



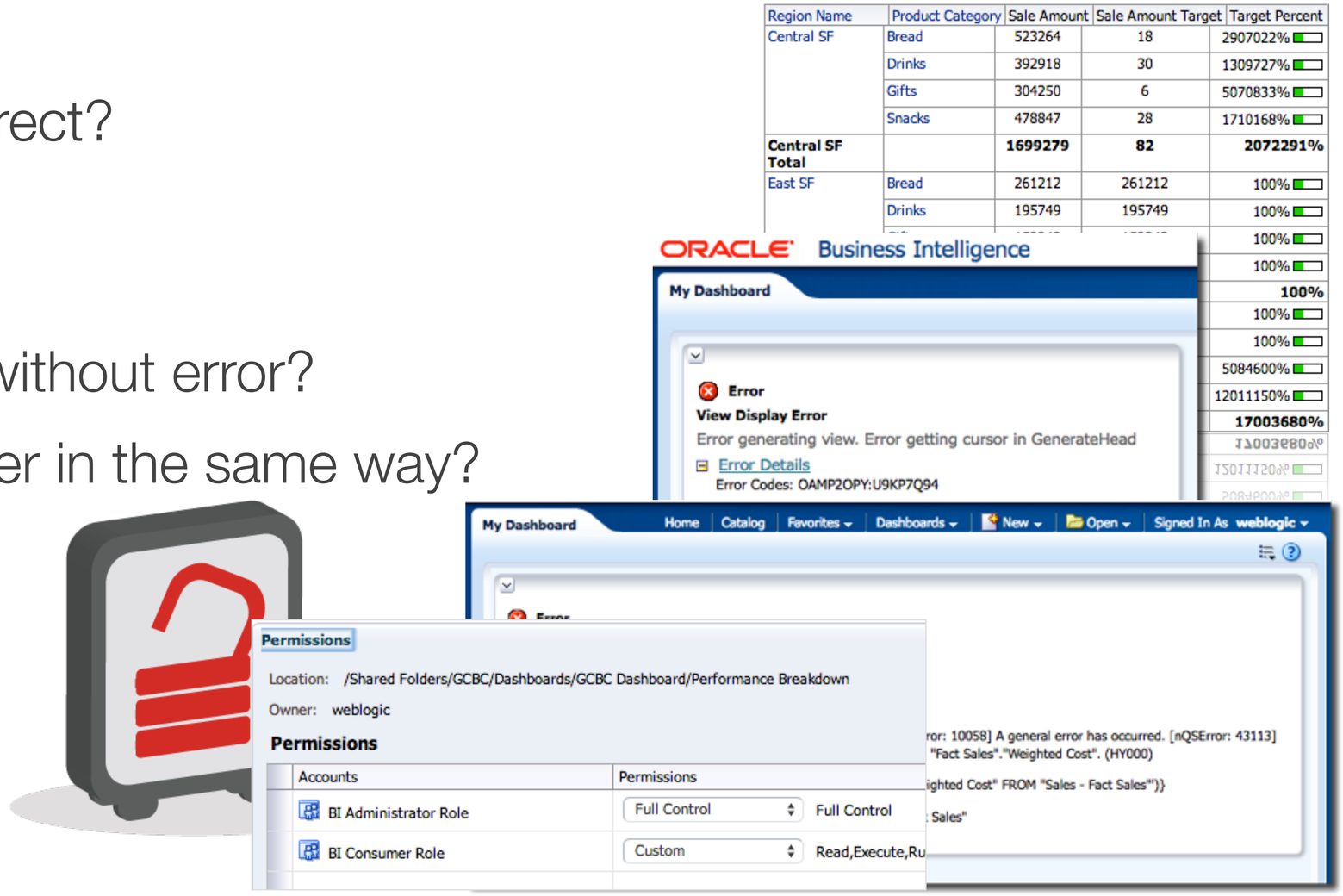
Save Time

- Manually checking for regressions
- **slow & error-prone**
- **limited test coverage**
- **boring!**

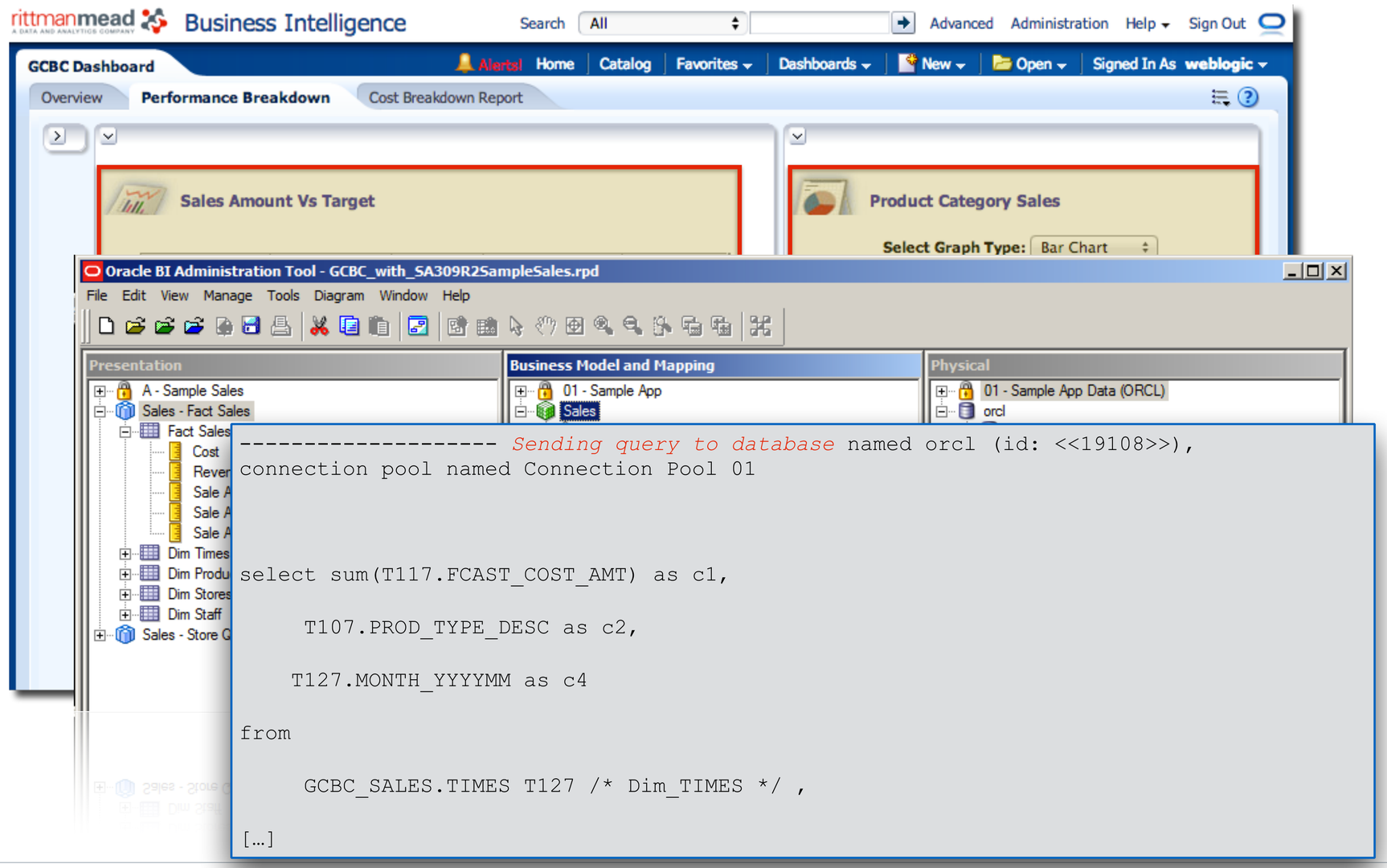
- Automated regression testing
- **fast & reliable**
- **much greater test coverage**

What Could Possibly Go Wrong?

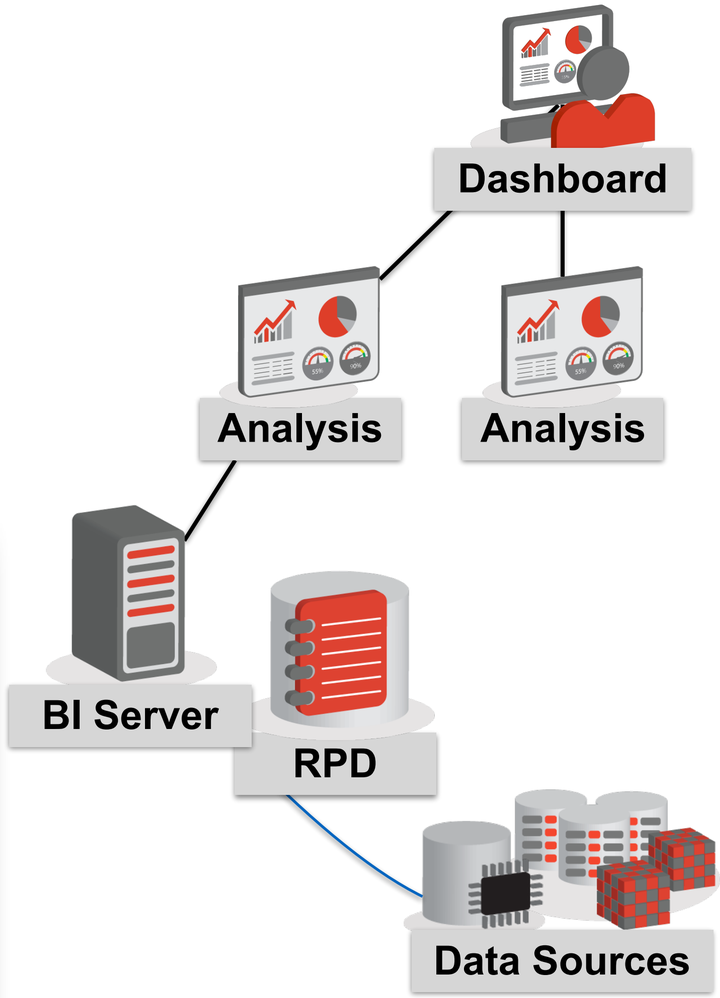
- Data
  - Are the numbers still correct?
- Functionality
  - Do dashboards still run without error?
  - Do dashboards still render in the same way?
- Security
  - Data
  - Visible Dashboards



OBIEE Conceptual Overview



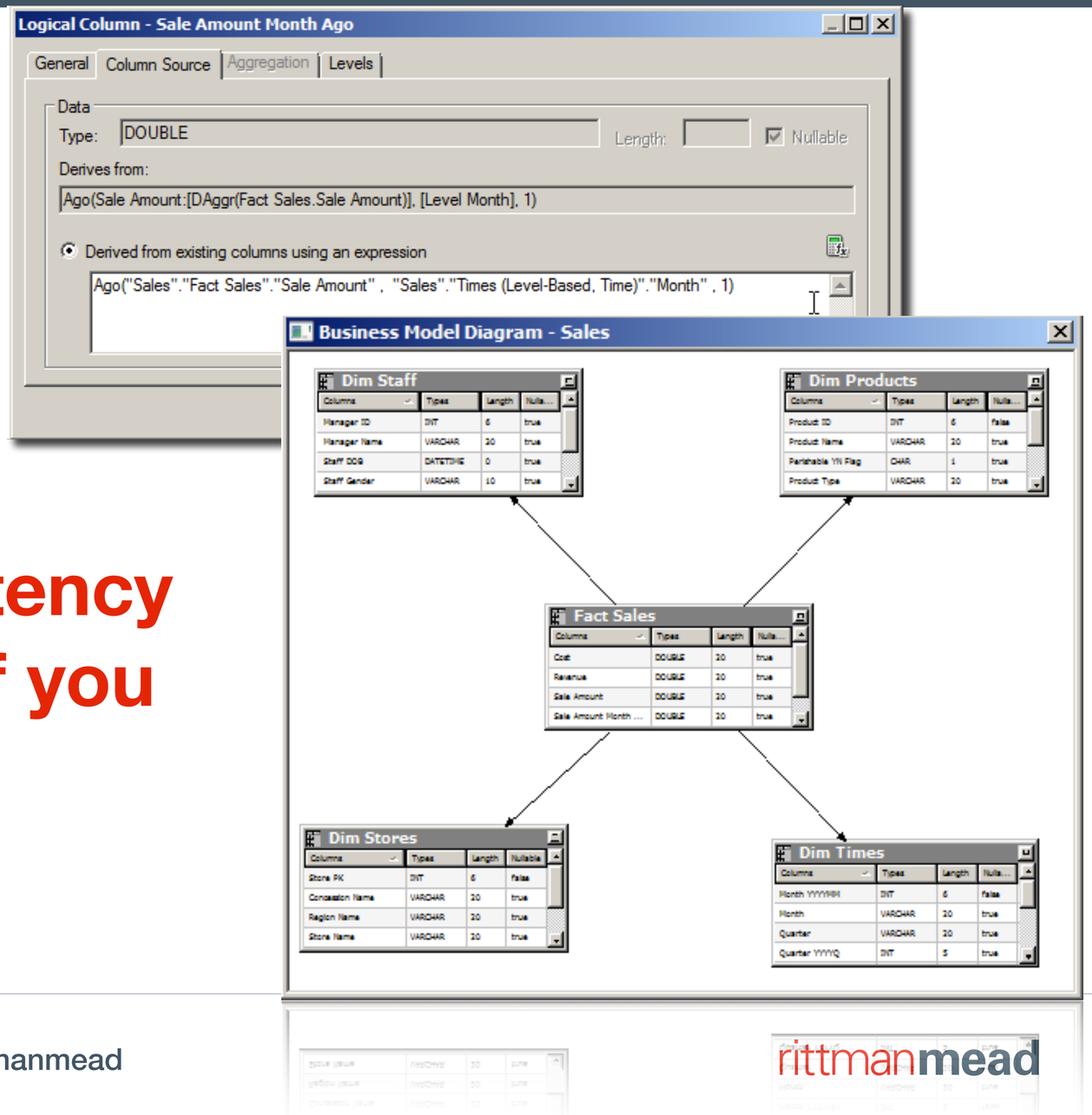

```
-------------------- Sending query to database named orcl (id: <<19108>>),
connection pool named Connection Pool 01


select sum(T117.FCAST_COST_AMT) as c1,
     T107.PROD_TYPE_DESC as c2,
    T127.MONTH_YYYYMM as c4
from
     GCBC_SALES.TIMES T127 /* Dim_TIMES */ ,
[…]
```



Whoops… I broke it!

1. The RPD

- Cleanup / Refactoring
- Developments
- Bugfixes

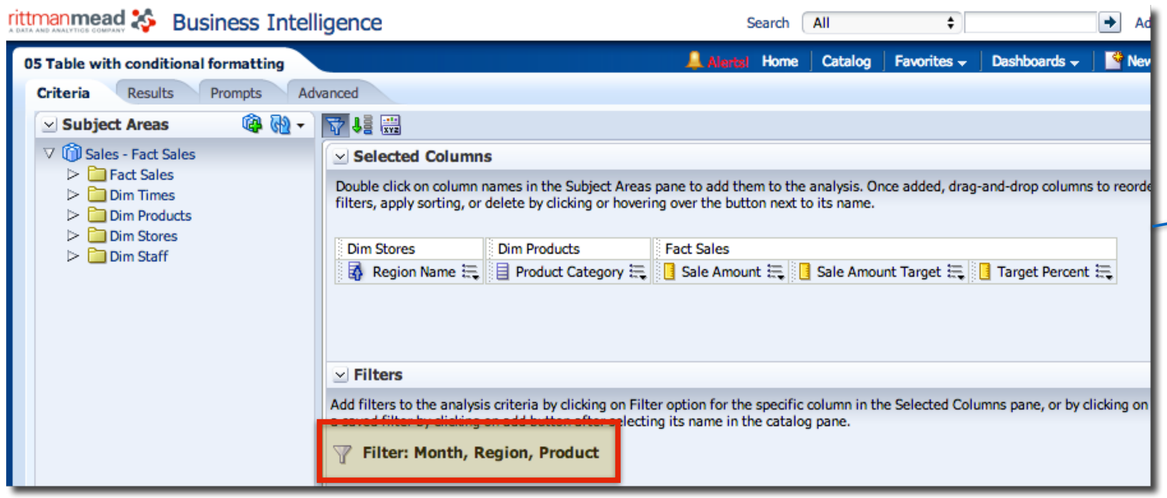


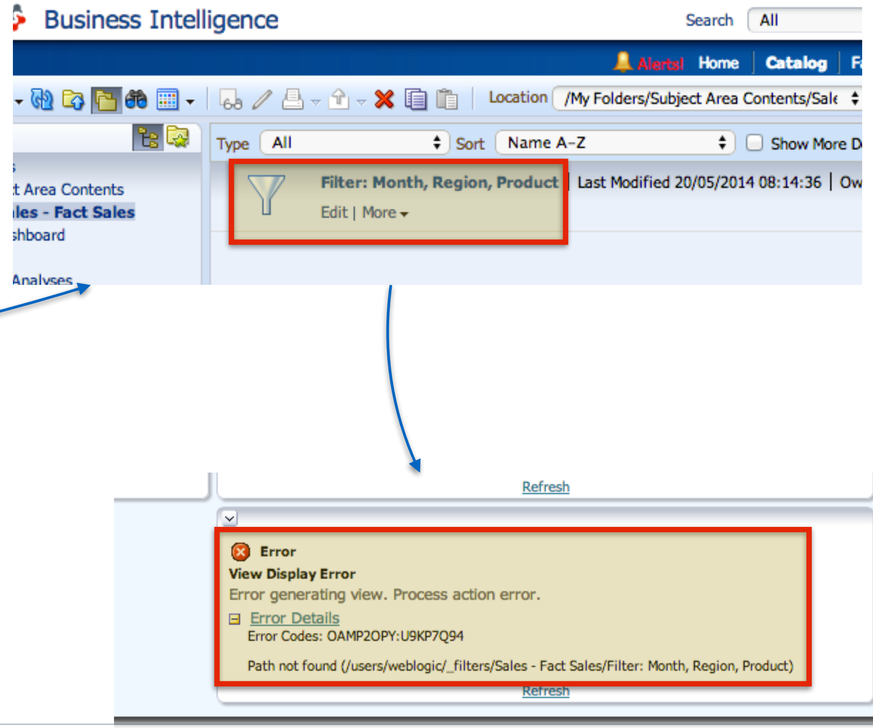
- **RPD may still pass consistency check - but do you <u>know</u> if you broke existing reports and dashboards?**

Whoops… I broke it!

2. OBIEE front end

- Cleanup / Refactored calculations
- Presentation Catalog changes
- Application Role changes

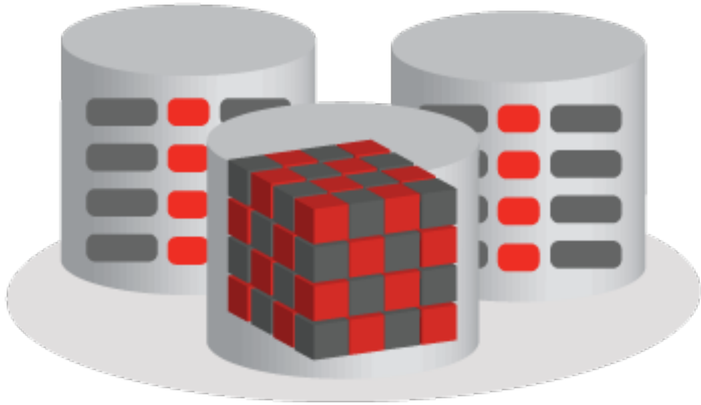




Whoops… I broke it!

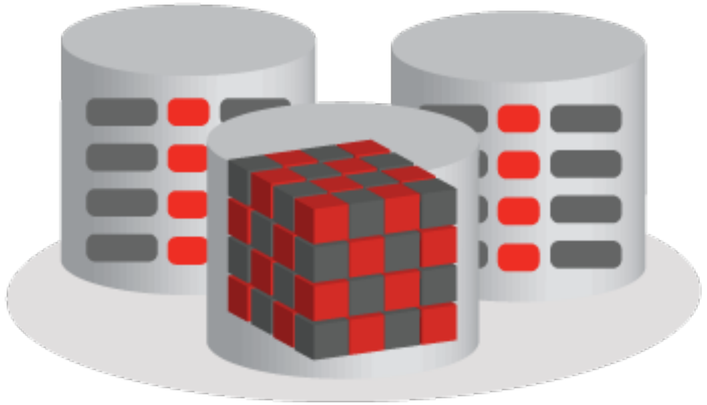
3. Database

- Refactored designs
  - View -> Table
  - Table -> MView
- Indexes
- Partitioning



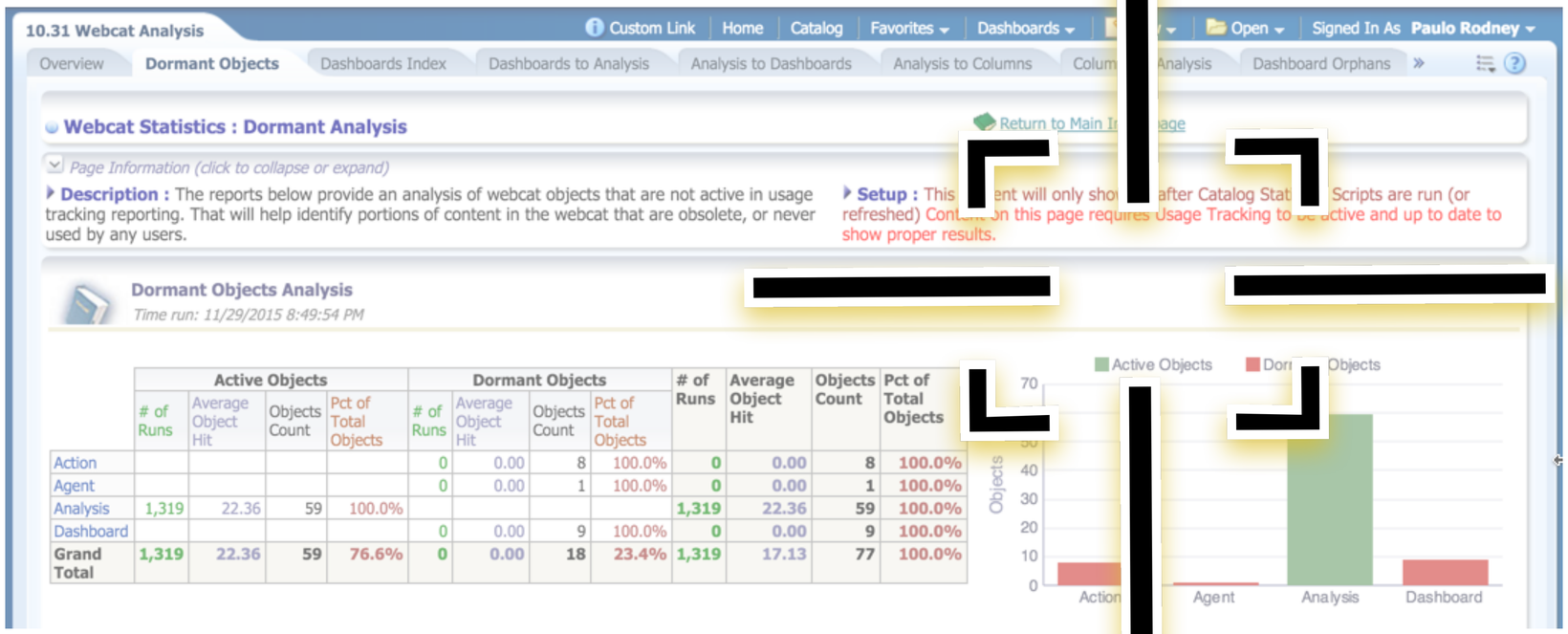
Whoops… I broke it …

- Software upgrades
- Environment changes

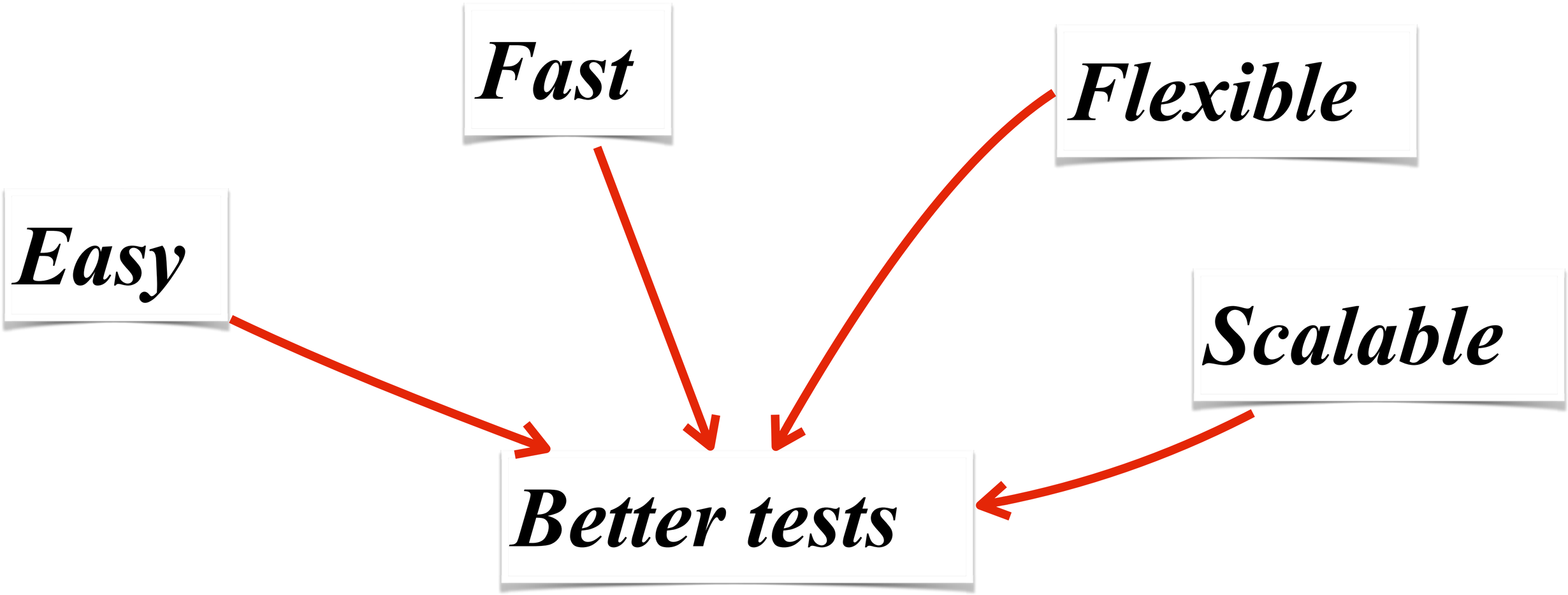


Scope

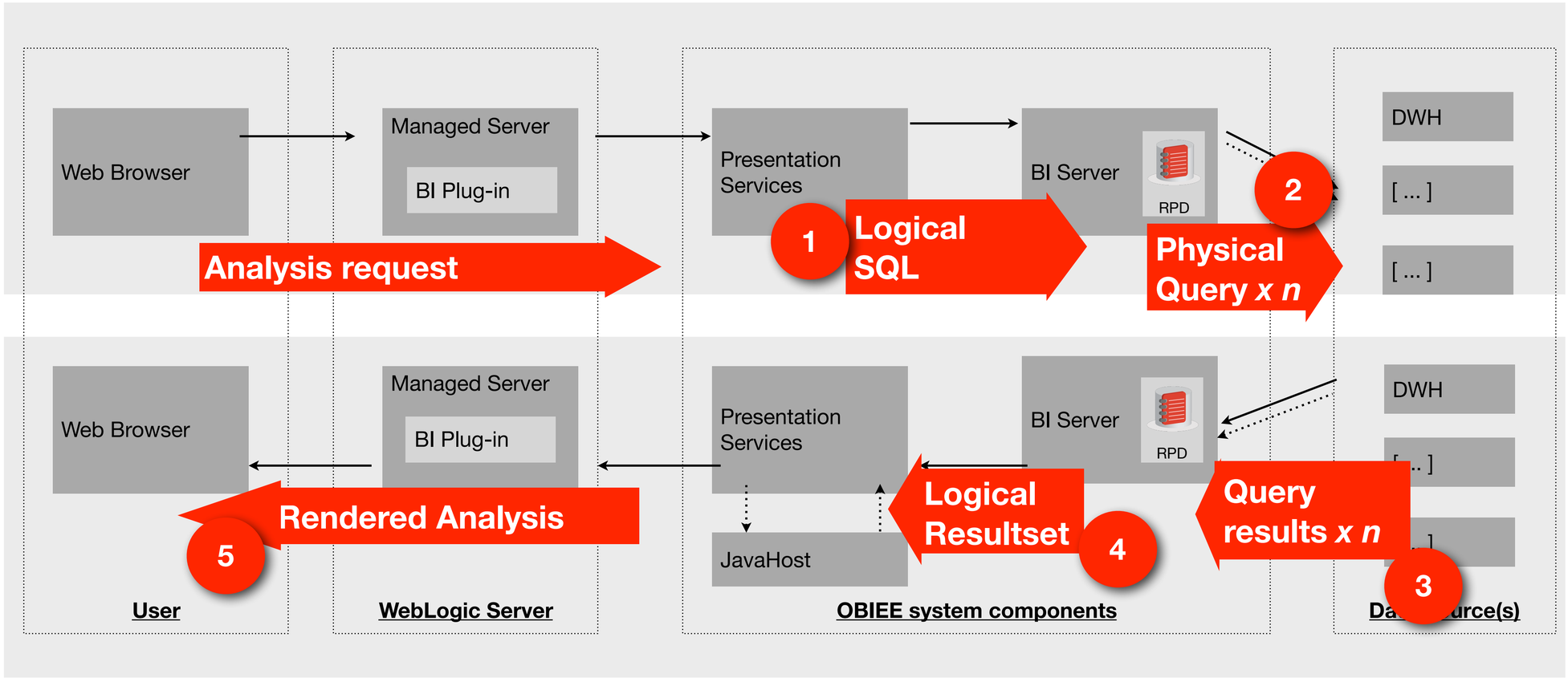
- Don’t waste time testing what’s not used
- Enable Usage Tracking **NOW**!



What Makes a Good Regression Test?



Where Can We Detect Problems?



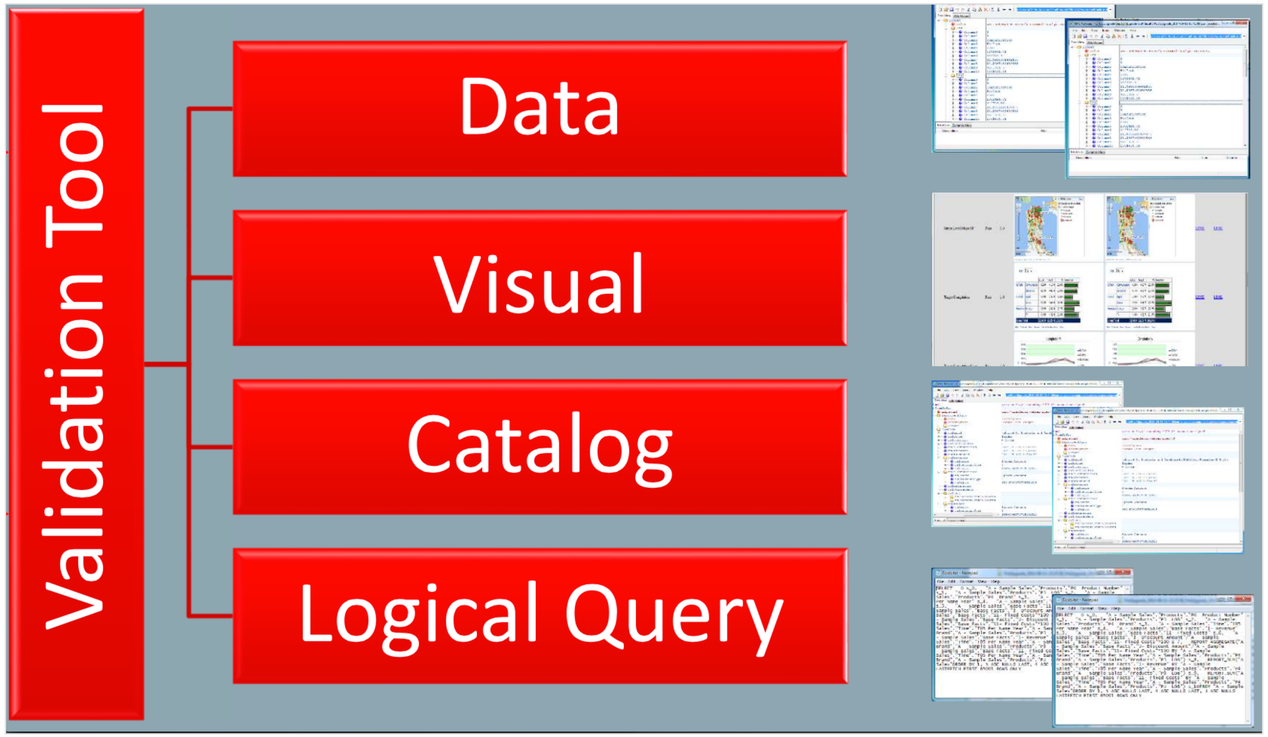
- Logical 1 4
- Physical 2 3
- Front End 5

Regression Testing Opportunities

- OBIEE **Logical** model
  - Does the RPD still work and return the same results for a given logical query?
- **Physical** Database
  - Does the Physical SQL that OBIEE generates still run?
- OBIEE **front end**
  - From the point of view of an end user, does it look right?

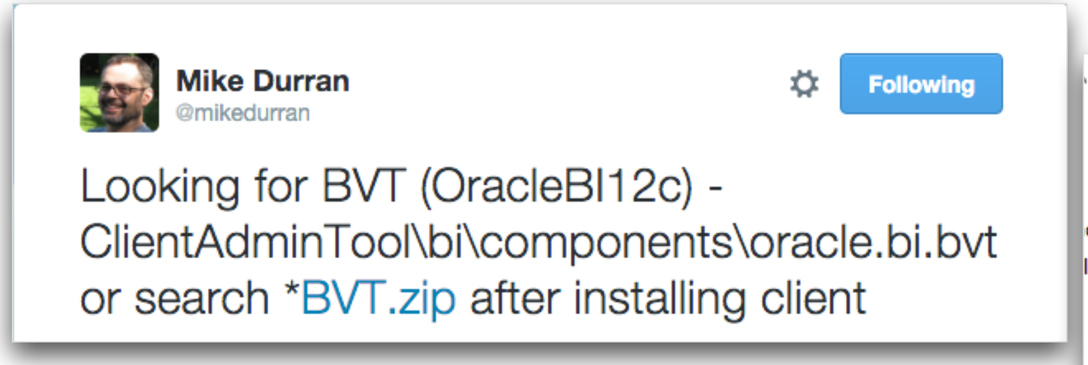
Baseline Validation Tool

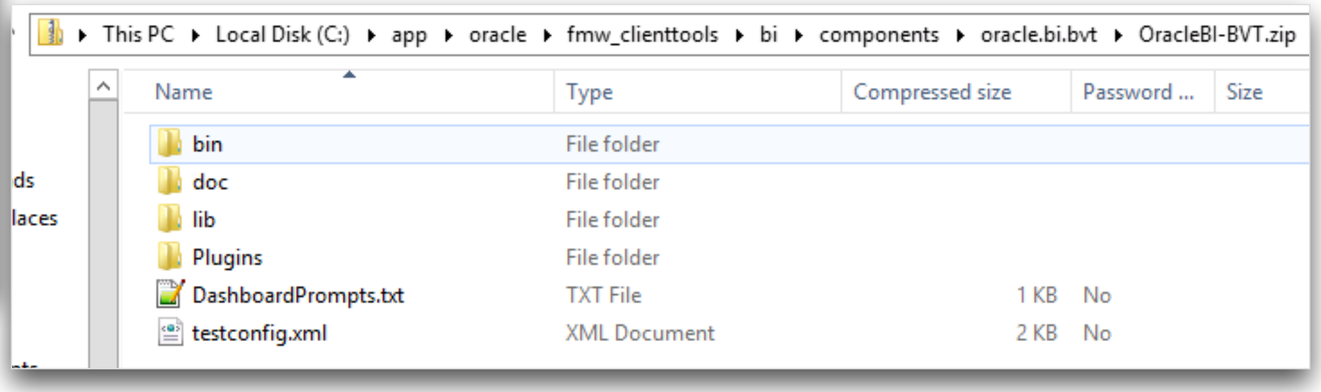
- New in OBIEE 12c
  - Available for use with 11g too
- Modular - run just the plugins you need for the test
  - Data
  - Logical query
  - Visual
  - BI catalog



Baseline Validation Tool

- Distributed only as part of the OBIEE 12c Windows Client Tools
- Hidden away …

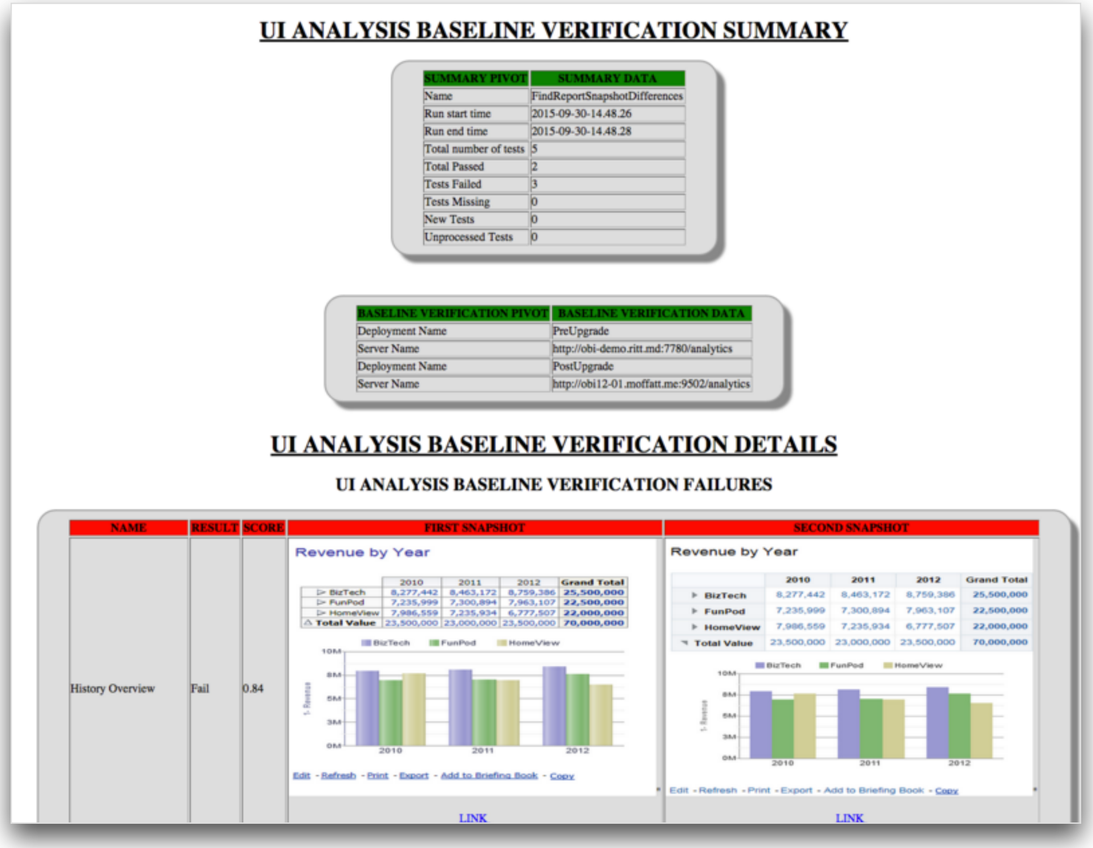




- Windows or Linux
- Check doc folder in the zip for full instructions

Baseline Validation Tool

- Set up an XML file pointing to your server(s)
- Run BVT initial
- Run BVT secondary
- Compare results



UI ANALYSIS BASELINE VERIFICATION SUMMARY

SUMMARY PIVOT	SUMMARY DATA
Name	FindReportSnapshotDifferences
Run start time	2015-09-30-14.48.26
Run end time	2015-09-30-14.48.28
Total number of tests	5
Total Passed	2
Tests Failed	3
Tests Missing	0
New Tests	0
Unprocessed Tests	0

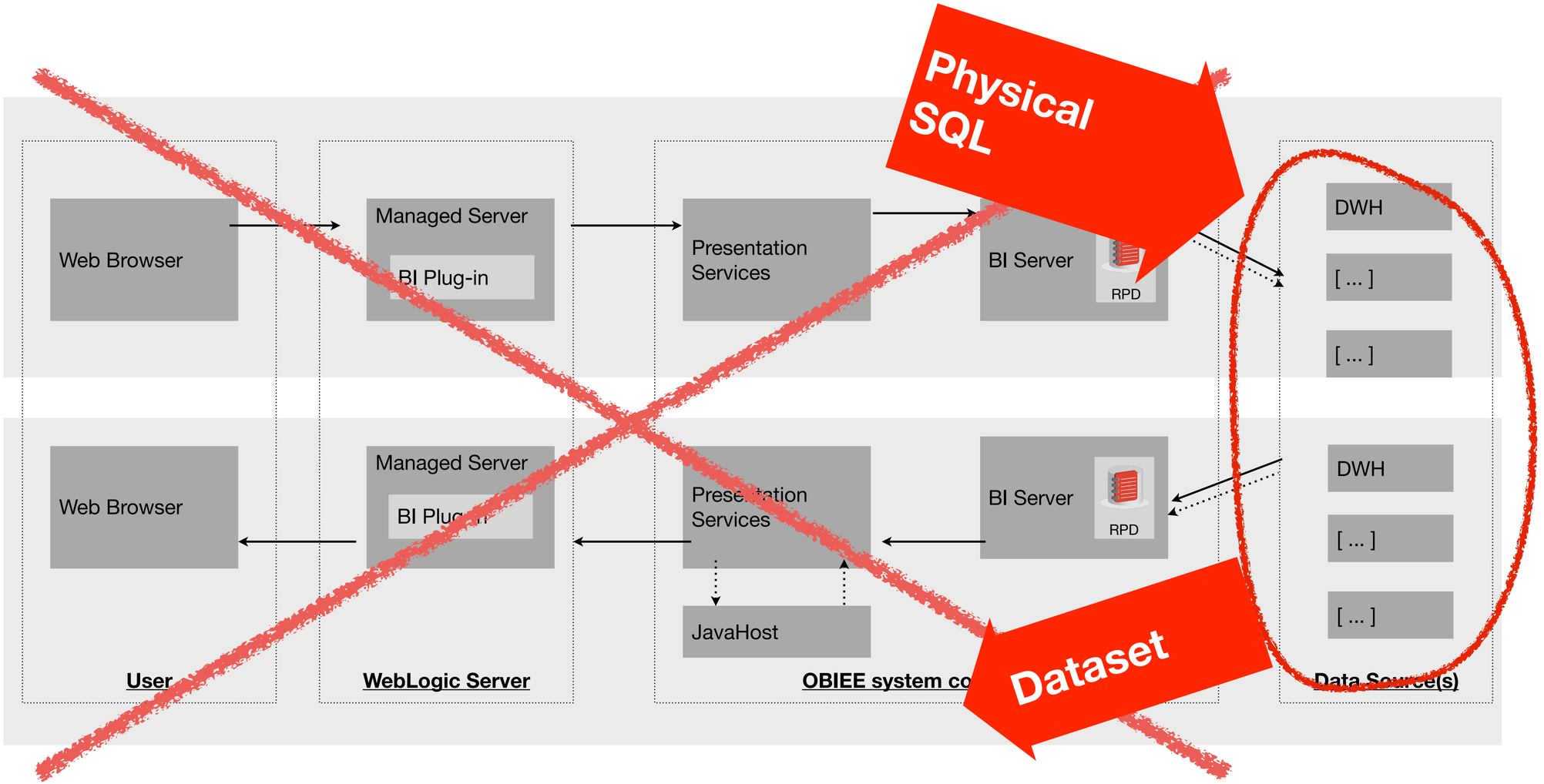
BASELINE VERIFICATION PIVOT	BASELINE VERIFICATION DATA
Deployment Name	PreUpgrade
Server Name	http://obi-demo.ritt.md:7780/analytics
Deployment Name	PostUpgrade
Server Name	http://obi12-01.moffatt.me:9502/analytics

UI ANALYSIS BASELINE VERIFICATION DETAILS

UI ANALYSIS BASELINE VERIFICATION FAILURES

NAME	RESULT	SCORE	FIRST SNAPSHOT	SECOND SNAPSHOT
History Overview	Fail	0.84	Revenue by Year 2010 2011 2012 Grand Total BizTech 8,277,442 8,463,172 8,759,386 25,500,000 FunPod 7,235,999 7,300,894 7,963,107 22,500,000 HomeView 7,986,559 7,235,934 6,777,507 22,000,000 Total Value 23,500,000 23,000,000 23,500,000 70,000,000 BizTech FunPod HomeView 10M 8M 6M 3M 0M $ Revenue 2010 2011 2012 Edit - Refresh - Print - Export - Add to Briefing Book - Copy LINK	Revenue by Year 2010 2011 2012 Grand Total BizTech 8,277,442 8,463,172 8,759,386 25,500,000 FunPod 7,235,999 7,300,894 7,963,107 22,500,000 HomeView 7,986,559 7,235,934 6,777,507 22,000,000 Total Value 23,500,000 23,000,000 23,500,000 70,000,000 BizTech FunPod HomeView 10M 8M 6M 3M 0M $ Revenue 2010 2011 2012 Edit - Refresh - Print - Export - Add to Briefing Book - Copy LINK

Regression Testing Database Changes



Regression Testing Database Changes

- If only the DB has changed, then just test the DB.

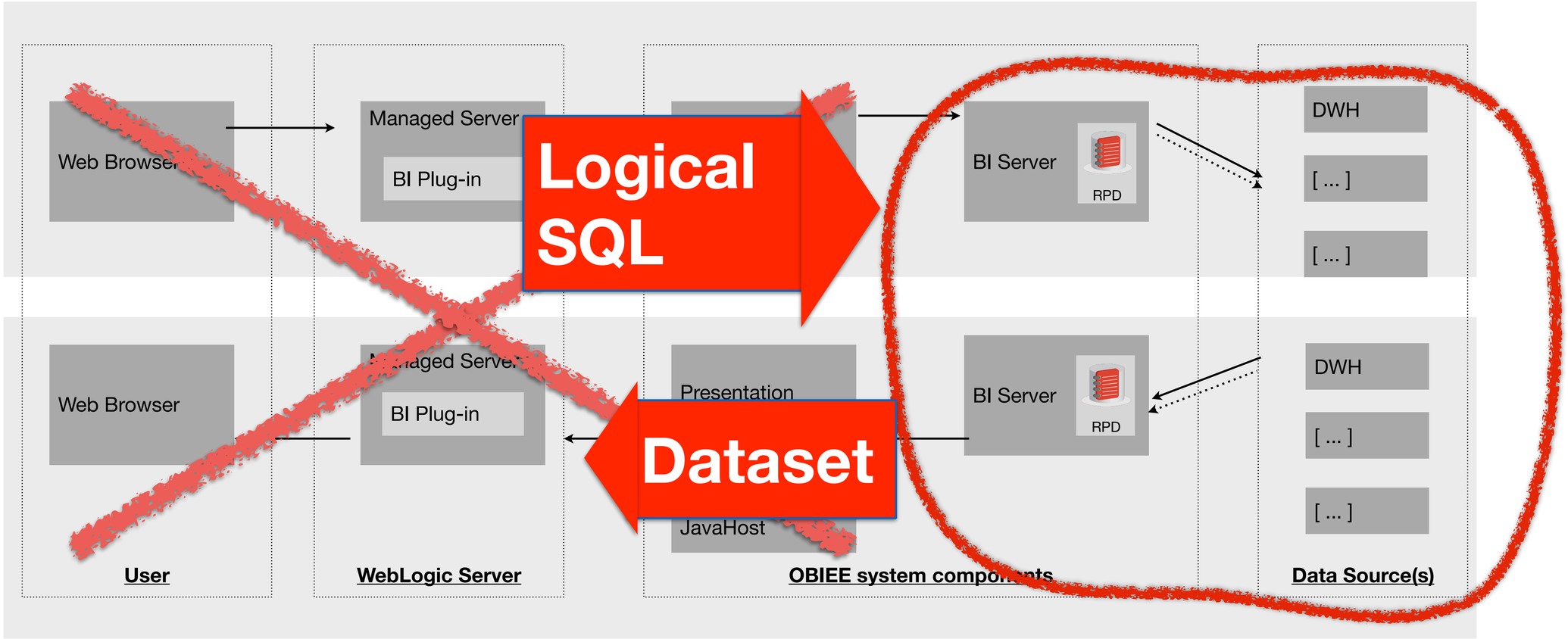
```
[2014-05-20T08:18:12.000+01:00] [OracleBIServerComponent] [TRACE:2] [USER-18] [] [ecid: 11d1def534e
0c7bfd:-8000-0000000000035b71,0:1:9:5] [tid: 73162700] [requestid: 8ad70015] [sessionid: 8ad70000]
] ------------------- Sending query to database named orcl (id: <<154362>>), connection pool named
, logical request hash 401299cd, physical request hash 9f60ebf5: [[^M

select sum(T117.FCAST_SAL_AMT) as c1,
     T107.PROD_CAT_DESC as c2,
     T880.REGION_NAME as c3
from
     GCBC_SALES.STORES_RAGGED T880 /* Dim_STORES_RAGGED */ ,
     GCBC_SALES.PRODUCTS T107 /* Dim_PRODUCTS */ ,
     GCBC_SALES.SALES T117 /* Fact_SALES */
where  ( T107.PROD_ID = T117.PROD_ID and T117.STORE_ID = T880.STORE_PK )
group by T107.PROD_CAT_DESC, T880.REGION_NAME
order by c2, c3
```

nqquery.log / Usage Tracking

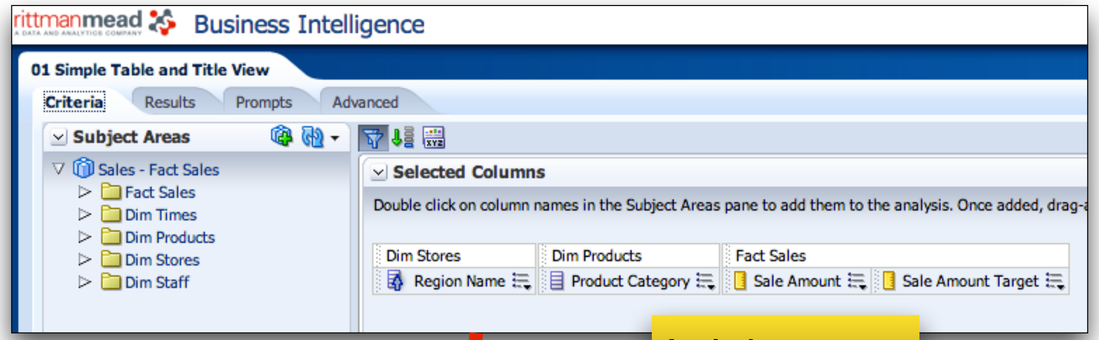
```
[oracle@rnm-ol6-2 ~]$ sqlplus gcbc_sales/Password01

SQL*Plus: Release 12.1.0.1.0 Production on Mon May 26 21:01:33 2014

Copyright (c) 1982, 2013, Oracle.  All rights reserved.

Last Successful login time: Mon May 26 2014 20:58:56 +01:00

Connected to:
Oracle Database 12c Enterprise Edition Release 12.1.0.1.0 - 64bit Production
With the Partitioning, OLAP, Advanced Analytics and Real Application Testing options

GCBC_SALES@orcl >
select sum(T117.FCAST_SAL_AMT) as c1,
     T107.PROD_CAT_DESC as c2,
     T880.REGION_NAME as c3
from
     GCBC_SALES.STORES_RAGGED T880 /* Dim_STORES_RAGGED */ ,
     GCBC_SALES.PRODUCTS T107 /* Dim_PRODUCTS */ ,
     GCBC_SALES.SALES T117 /* Fact_SALES */
where  ( T107.PROD_ID = T117.PROD_ID and T117.STORE_ID = T880.STORE_PK )
group by T107.PROD_CAT_DESC, T880.REGION_NAME
 10  order by c2, c3
 11  ;

        C1 C2                   C3
---------- -------------------- --------------------
    523264 Bread                Central SF
    261212 Bread                East SF
    261399 Bread                North CA
   1308410 Bread                North SF
    783494 Bread                Other USA
   1045747 Bread                South CA
    522998 Bread                West SF
    392918 Drinks               Central SF
    195749 Drinks               East SF
    196024 Drinks               North CA
    980720 Drinks               North SF
    589256 Drinks               Other US
```

SQL*Plus

Logical OBIEE Regression Testing



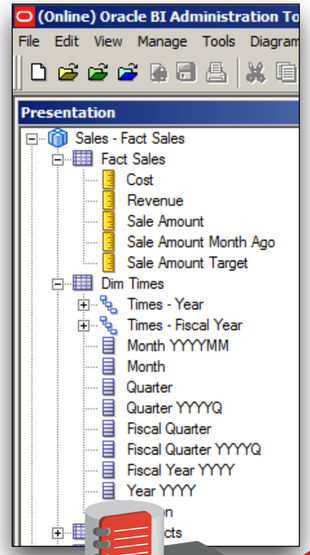
Logical SQL in OBIEE



Analysis

```
[2014-05-20T08:18:12.000+01:00] [OracleBIServerComponent] [TRACE:2] [USER-0] [] [ecid: 11d1def534ea1
######################################## [[^M
------------------- SQL Request, logical request hash:
401299cd
SET VARIABLE QUERY_SRC_CD='Report',SAW_SRC_PATH='/shared/weblogic/GCBC Analyses/01 Simple Table and
SELECT^M
   0 s_0,^M
   "Sales - Fact Sales"."Dim Products"."Product Category" s_1,^M
   "Sales - Fact Sales"."Dim Stores"."Region Name" s_2,^M
   "Sales - Fact Sales"."Fact Sales"."Sale Amount Target" s_3,^M
   "Sales - Fact Sales"."Fact Sales"."Sale Amount" s_4,^M
   REPORT_SUM("Sales - Fact Sales"."Fact Sales"."Sale Amount Target" BY "Sales - Fact Sales"."Dim St
   REPORT_SUM("Sales - Fact Sales"."Fact Sales"."Sale Amount" BY "Sales - Fact Sales"."Dim Stores"."
FROM "Sales - Fact Sales"^M
) djm ORDER BY 1, 3 ASC NULLS LAST, 2 ASC NULLS LAST^M
FETCH FIRST 65001 ROWS ONLY^M
```

Logical SQL



RPD

BI Server

Analysis results

Region Name	Product Category	Sale Amount	Sale Amount Target
Central SF	Bread	523,264.00	18.00
	Drinks	392,918.00	30.00
	Gifts	304,250.00	6.00
	Snacks	478,847.00	28.00
Central SF Total		**1,699,279.00**	**82.00**
East SF	Bread	261,212.00	
	Drinks	195,749.00	
East SF Total			
North CA			
North CA Total			
North SF			
North SF Total			
Other USA			

```
[oracle@rnm-ol6-2 ~]$ nqcmd -d AnalyticsWeb -u weblogic -p Passwo

-------------------------------------------------------------------
         Oracle BI ODBC Client
         Copyright (c) 1997-2013 Oracle Corporation, All rights
-------------------------------------------------------------------


Connection open with info:
[0][State: 01000] [DataDirect][ODBC lib] Application's WCHAR type
SELECT s_0, s_1, s_2, s_3, s_4, s_5, s_6 FROM ( SELECT 0 s_0, "Sa
les - Fact Sales"."Fact Sales"."Sale Amount" s_4, REPORT_SUM("Sale
les - Fact Sales"."Dim Stores"."Region Name") s_6 FROM "Sales - Fa

SELECT s_0, s_1, s_2, s_3, s_4, s_5, s_6 FROM ( SELECT 0 s_0, "Sa
les - Fact Sales"."Fact Sales"."Sale Amount" s_4, REPORT_SUM("Sale
les - Fact Sales"."Dim Stores"."Region Name") s_6 FROM "Sales - Fa

-------------------------------------------------------------------
"s_0"        "s_1"                "s_2"                "s_3"
-------------------------------------------------------------------
0            Bread                Central SF           18.00
0            Drinks               Central SF           30.00
0            Gifts                Central SF           6.00
0            Snacks               Central SF           28.00
0            Drinks               West SF              19.00
0            Gifts                West SF
0            Snacks               West SF              6.00
-------------------------------------------------------------------
Row count: 28
-------------------------------------------------------------------


Processed: 1 querie
```

Resultset via nqcmd

Baseline Validation Tool

- Use the **report** and **logicalquery** test plugins
- Connects to the server and runs each analysis
- Stores the results as CSV
- Stores the Logical SQL

```
<Tests>
    <TestPlugin name="com.oracle.biee.bvt.plugin.catalog" enabled="false">
    <TestPlugin name="com.oracle.biee.bvt.plugin.ui" enabled="false">
    <TestPlugin name="com.oracle.biee.bvt.plugin.report" enabled="true">
        <!-- Timeout for loading each report in MSecs should be between 5 secs and 10 mins -->
        <Parameter name="ReadTimeout" value="15000" />
        <Test name="ExportReportsToCSV" enabled="true">
            <Parameter name="CatalogRoot" value="/shared/01. QuickStart/Simple Demo Dashboard/Customers"/>
            <!-- Set a limit on the maximum tolerance for fluctuations in floating point numbers in report
            <Parameter name="DiffTolerance" value="0"/>
        </Test>
    </TestPlugin>
    <TestPlugin name="com.oracle.biee.bvt.plugin.logicalquery" enabled="true">
        <Test name="GetLogicalQueries" enabled="true">
            <Parameter name="CatalogRoot" value="/shared/01. QuickStart/Simple Demo Dashboard/Customers"/>
        </Test>
    </TestPlugin>
    <TestPlugin name="com.oracle.biee.bvt.plugin.dashboard" enabled="false">
</Tests>
```

```
  INFO: ----------------------------------------------
  INFO: Plugin: com.oracle.biee.bvt.plugin.sample
  INFO: Description: Sample Plugin
  INFO:  Test        : Test1
  INFO:  Description: Provide a description of the test
  INFO: ----------------------------------------------
  INFO: Plugin: com.oracle.biee.bvt.plugin.ui
  INFO: Description: UI Verification Plugin
  INFO:  Test        : FindReportSnapshotDifferences
  INFO:  Description: Takes Snapshot of given deployment to be compared later
  INFO:  Test        : FindDashboardSnapshotDifferences
  INFO:  Description: Takes Snapshot of dashboards with prompt links to be compared later
  INFO:  Test        : FindNotRenderedComponents
  INFO:  Description: Finds not rendered components in reports
C:\Users\Administrator\OracleBI-BVT>bin\obibvt -config testconfig.xml -deployment Baseline
  INFO: Result folder: Results\Baseline
  INFO: SamplePlugin: Initialized
  INFO: SamplePlugin: Set Up for Test Run
  INFO: Starting [com.oracle.biee.bvt.plugin.logicalquery.LogicalQueryPlugin]:[GetLogicalQueries]
  INFO: LogicalQueryPlugin: GetLogicalQueries()
Catalog Items Found: 2

  INFO: Found 2 reports
Saving Logical-SQLs[==================================================] 100%

  INFO: getLogicalQueriesAsync returned
  INFO: [com.oracle.biee.bvt.plugin.logicalquery.LogicalQueryPlugin]:[GetLogicalQueries] returned in 18 seconds
  INFO: ReportPlugin: Initialized
  INFO: ReportPlugin: Set Up for Test Run
  INFO: Starting [com.oracle.biee.bvt.plugin.report.ReportPlugin]:[ExportReportsToCSV]
  INFO: Getting report items from server: http://sampleapp.rittmanmead.com:7780/analytics
Catalog Items Found: 2  INFO: Total of 2 reports found, exporting CSV for reports
  INFO: Timeout to download single report is set to 15000 MSecs
Processing report[==================================================] 100%

  INFO: ExportReportsToCSV completed with results file located at : C:\Users\Administrator\OracleBI-BVT\Results\Baseline
\com.oracle.biee.bvt.plugin.report\Results.xml
  INFO: [com.oracle.biee.bvt.plugin.report.ReportPlugin]:[ExportReportsToCSV] returned in 41 seconds
C:\Users\Administrator\OracleBI-BVT>
```

Baseline Validation Tool

- Make a change to your system - or point BVT at a different environment
- Run the same test again, specifying the second **deployment** in the XML

```
<TestConfiguration>
    <Deployment name="Baseline" description="Environment Baseline">
        <Server>
            <!-- AnalyticsURL Needs to point to the analytics page -->
            <!-- ex: <AnalyticsURL>http://servername:9704/analytics</AnalyticsURL> -->
            <!-- ex: <AnalyticsURL>https://servername/analytics</AnalyticsURL> -->
            <!-- If you are using a test certificate on the server for SSL and want to
                 to bypass SSL certificate validation, set the IgnoreSSLCertErrors to true
                 This setting is strictly for Test environments only -->
            <AnalyticsURL>http://sampleapp.rittmanmead.com:7780/analytics</AnalyticsURL>
            <UserName>Rick</UserName>
            <Password>Astley</Password>
            <IgnoreSSLCertErrors>false</IgnoreSSLCertErrors>
        </Server>
    </Deployment>
    <Deployment name="AfterChanges" description="After code drop 2.0 was made">
        <Server>
            <!-- AnalyticsURL Needs to point to the analytics page -->
            <!-- ex: <AnalyticsURL>http://servername:9704/analytics</AnalyticsURL> -->
            <!-- ex: <AnalyticsURL>https://servername/analytics</AnalyticsURL> -->
            <!-- If you are using a test certificate on the server for SSL and want to
                 to bypass SSL certificate validation, set the IgnoreSSLCertErrors to true
                 This setting is strictly for Test environments only -->
            <AnalyticsURL>http://sampleapp.rittmanmead.com:7780/analytics</AnalyticsURL>
            <UserName>NeverGoing</UserName>
            <Password>ToGiveYouUp</Password>
            <IgnoreSSLCertErrors>false</IgnoreSSLCertErrors>
        </Server>
    </Deployment>
```

Baseline Deployment/ Environment

Secondary Deployment/ Environment

```
./bin/obibvt -deployment AfterChanges -config testconfig.xml
```

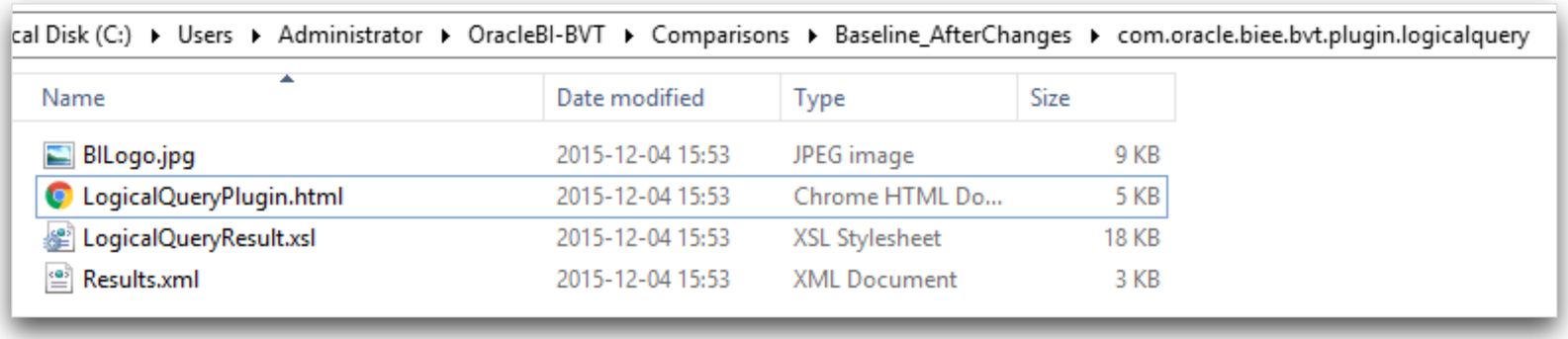
Baseline Validation Tool

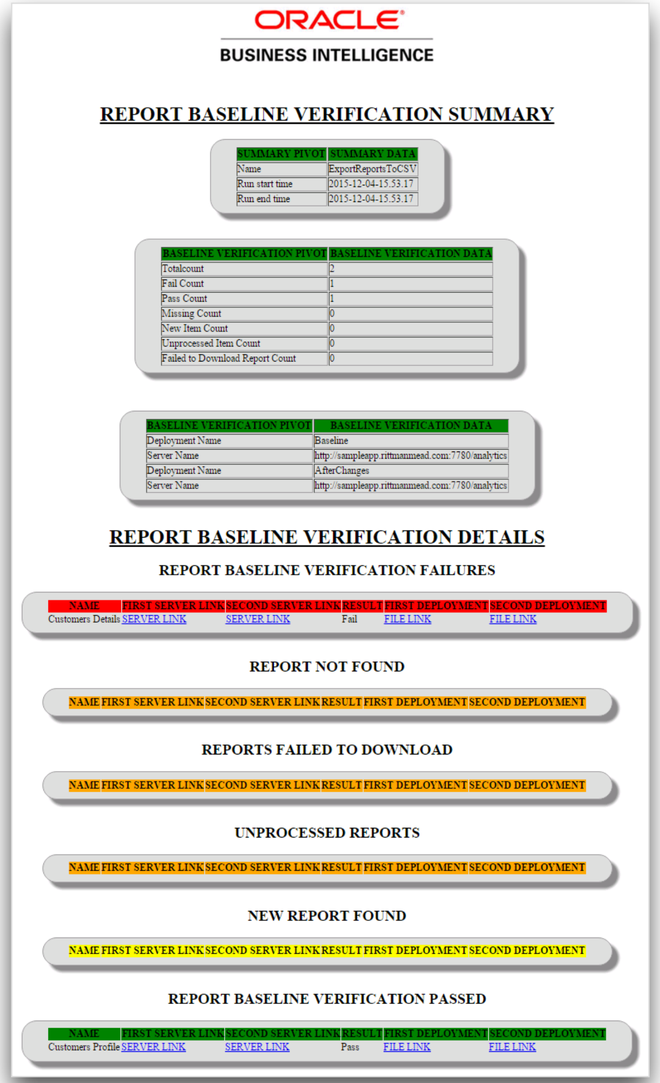
- Once you've got your two samples, run BVT again to compare them
- It compares the CSV and Logical SQL on disk and reports any differences
- Writes one HTML file per test plugin

```
./bin/obibvt -compareresults Results/Baseline Results/AfterChange -config testconfig.xml
```

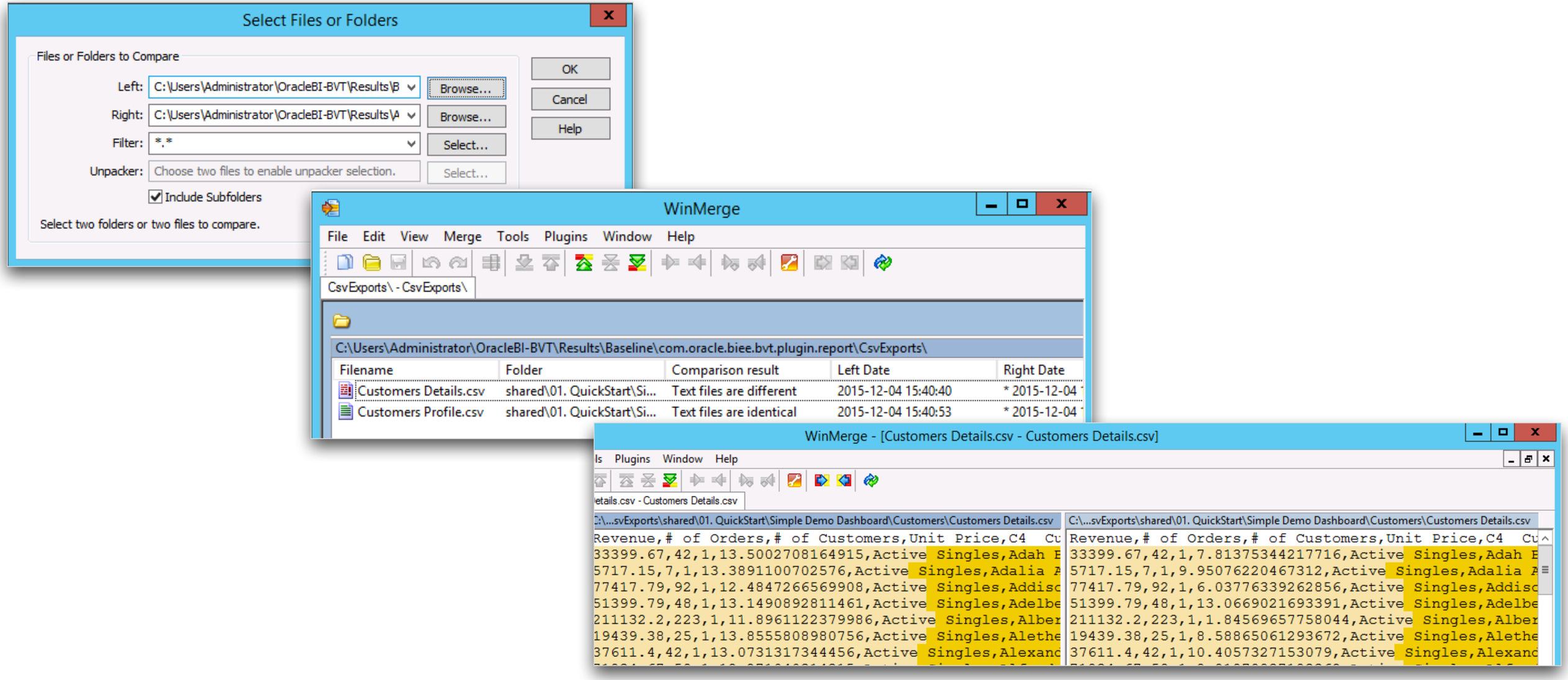
Baseline Validation Tool

- Links to view report on each environment and files being compared
- If you want to know the actual difference you'll need to run your own diff tool (eg WinMerge)





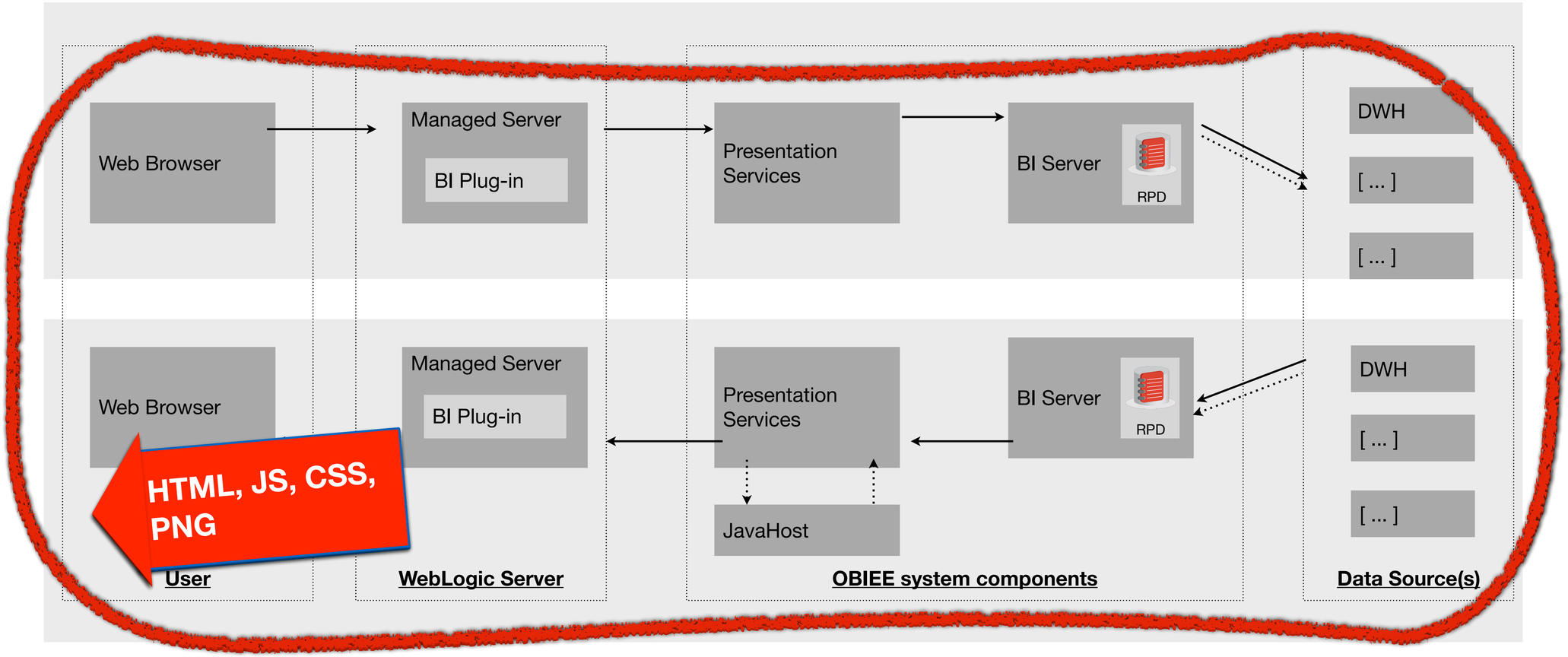
Baseline Validation Tool



Baseline Validation Tool

- Be aware of the config option “fudge factor” (DiffTolerance) necessary to deal with handling of floating point numbers across platforms
- Watch out for false negatives with Logical SQL from expected variance in **FETCH FIRST xxxx ROWS** etc

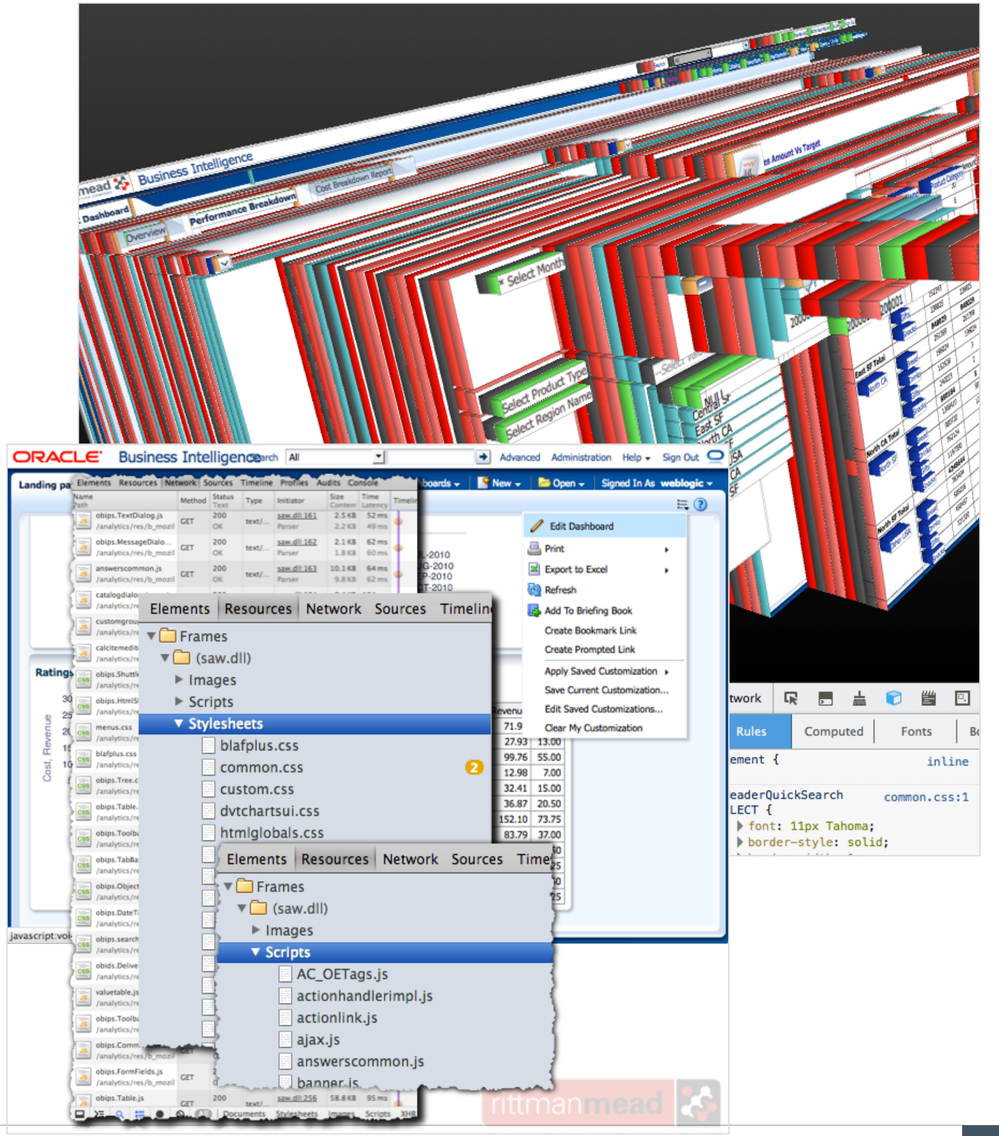
Regression Testing the OBIEE Front End



Regression Testing the OBIEE Front End

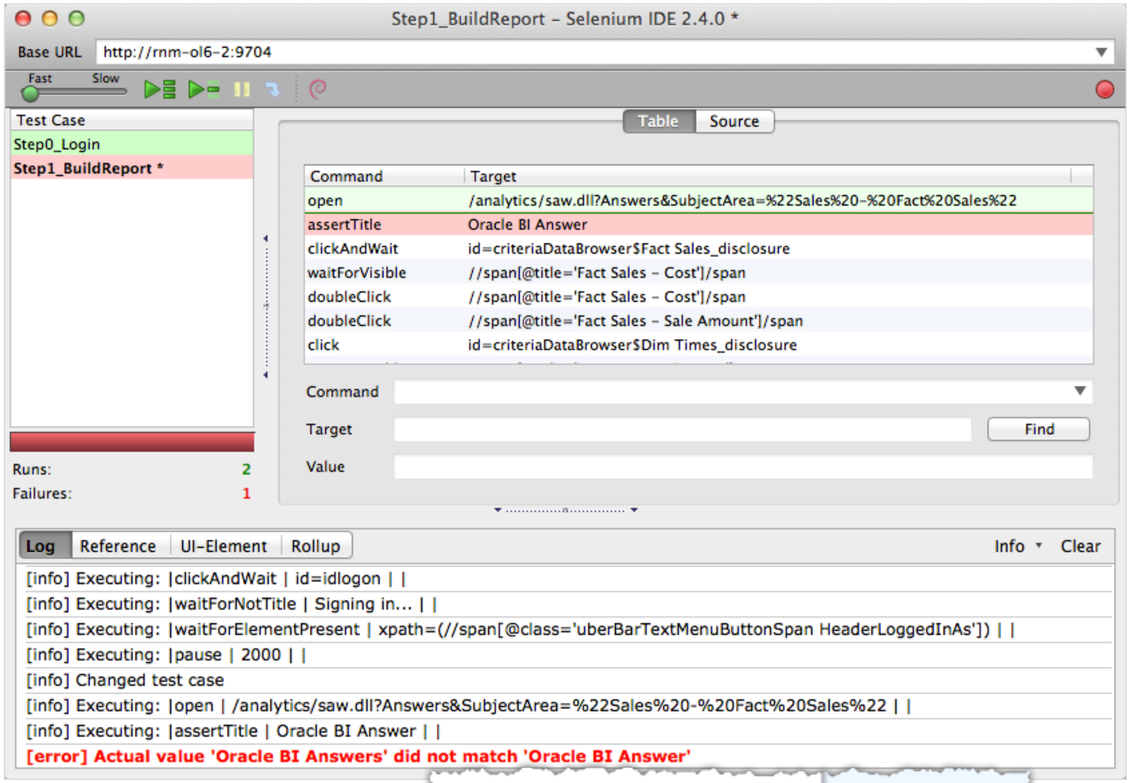
- Front End testing is complex!

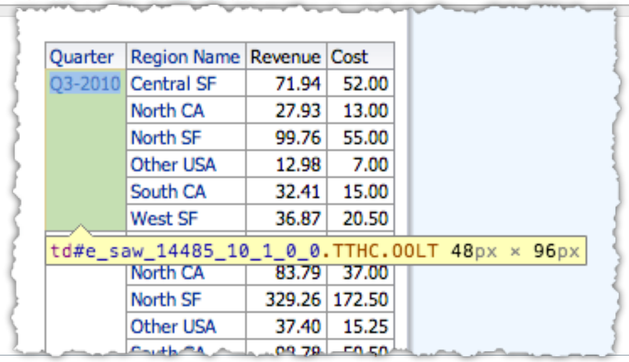
- Two options to make sense of HTML, JavaScript, CSS, images:
  - Programatically - Parse server response
  - Visually - Render server response



Front End test methods: Parsing

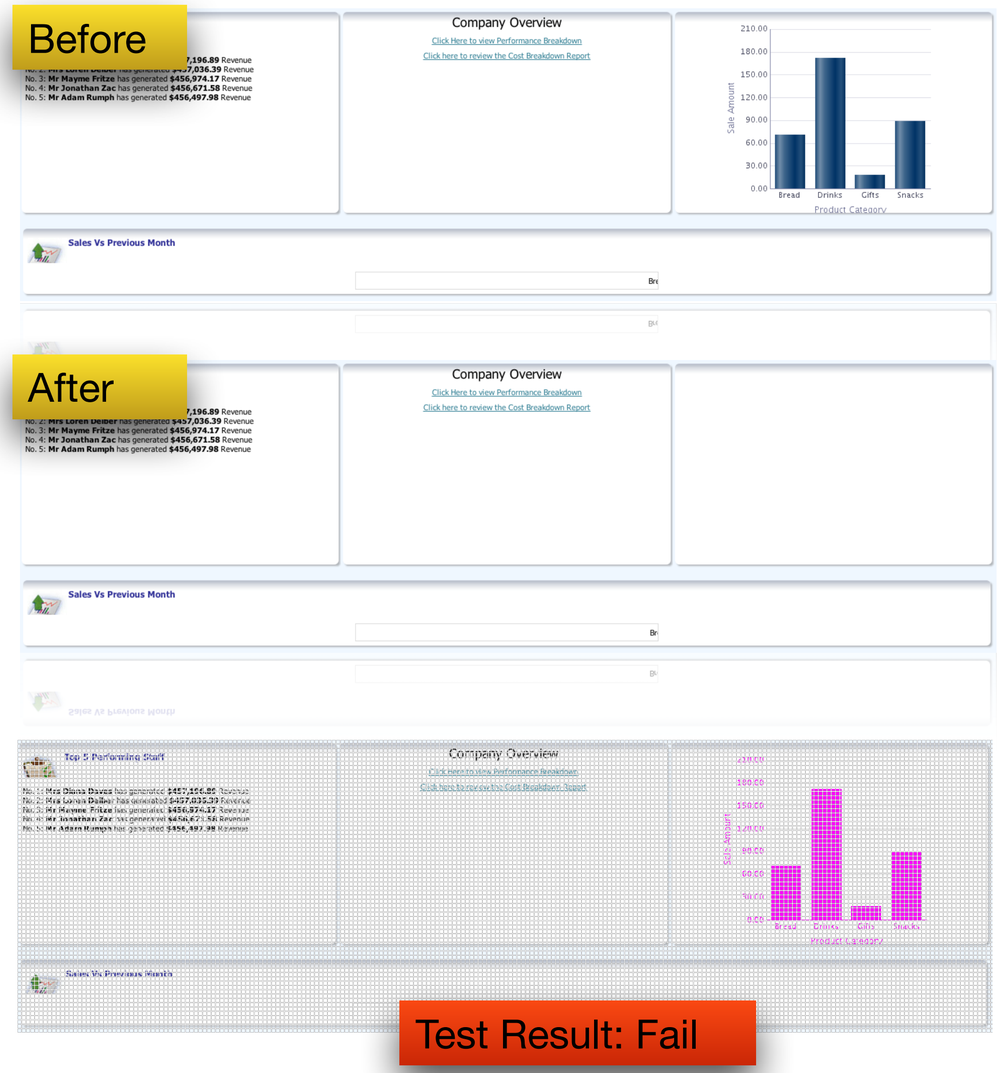
- Makes pass/fail tests easier
  - A string is present, or it is not
- Higher rate of false negatives
  - It's easier to miss problems
- High development & maintenance cost
  - Need to reverse-engineer DOM
  - Often relies on non-deterministic internal IDs to accurately pinpoint assertions





Front End test methods: Rendering

- More accurate
  - Can detect differences not expected or explicitly coded for
- More prone to false positives
  - Lots of things change on a page for valid reasons (dates, alerts, etc)
- Still requires DOM knowledge but less reliance on internal IDs



Visual Regression Testing

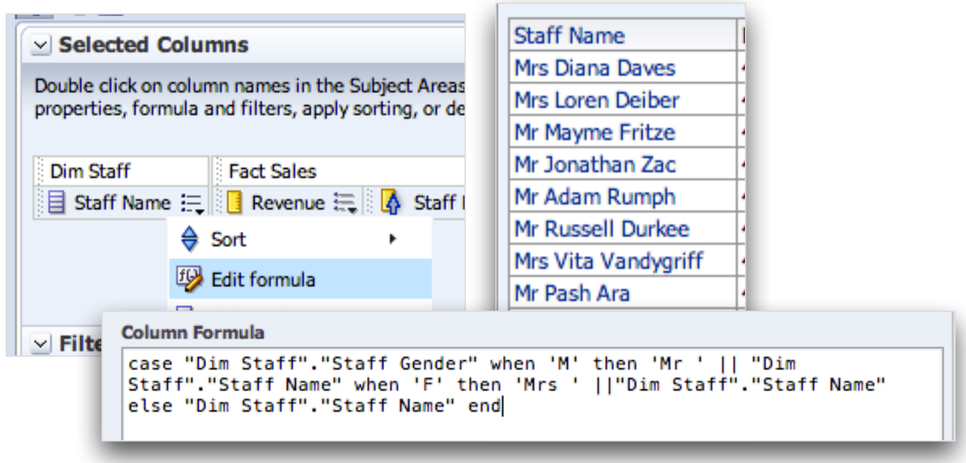
- Toolset
  - CasperJS
  - PhantomCSS

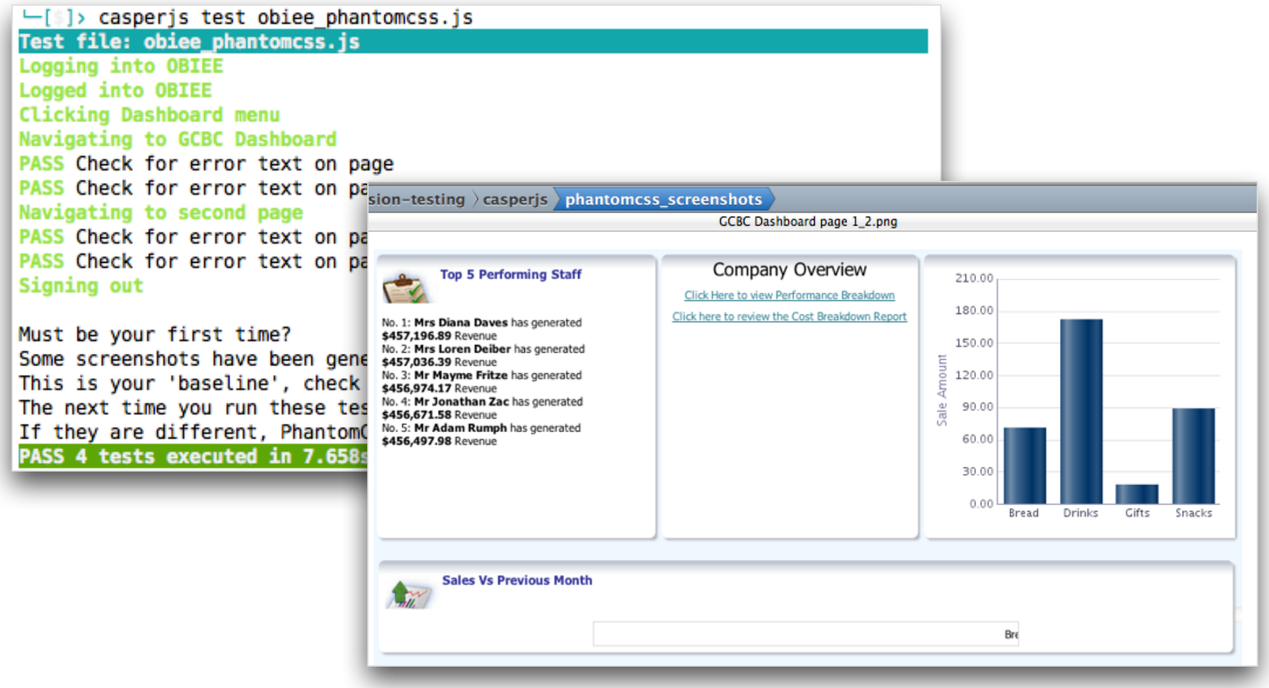
```
FAIL Visual change found for screenshot ./phantomcss_screenshots/GCBC Dashboard page 1_2.png (1.11% mismatch)
#    type: fail
#    file: obiee_phantomcss.js
#    subject: false

PASS No changes found for screenshot ./phantomcss_screenshots/GCBC Dashboard page 2_3.png

PASS No changes found for screenshot ./phantomcss_screenshots/Logged out_4.png

PASS No changes found for screenshot ./phantomcss_screenshots/Login page_0.png

PhantomCSS found 5 tests, 2 of them failed.
```

- Server based, no dependency on desktop or web browser
  - Uses PhantomJS, WebKit-based “headless” browser

```
casper.then(function() {
  this.echo('Clicking Dashboard menu','INFO')
        casper.click('#dashboard');
  this.waitUntilVisible('div.HeaderPopupWindow', function() {
    // We only want to snapshot the list itself; the rest of the home page has lots of
    // other changes (recent docs) that confuse matters.
    // Snapshot is restricted down to "HeaderSharedProtals" [sic] so as to ignore the
    // Most Recent on the Dashboads list. However, the changing width that a different
    // length recent dashboard name screws this approach up too.
    phantomcss.screenshot('div.HeaderSharedProtals','Dashboard list');
  });
});

casper.then(function(){
  this.echo('Navigating to GCBC Dashboard','INFO')
  casper.clickLabel('GCBC Dashboard');
})

casper.waitForUrl('http://rnm-ol6-2:9704/analytics/saw.dll?dashboard', function() {
  casper.waitWhileVisible('div.AjaxLoadingOpacity', function() {
    casper.waitWhileVisible('div.ProgressIndicatorDiv', function() {
      this.test.assertTextDoesntExist('Invalid Link Path', 'Check for error text on page');
      this.test.assertTextDoesntExist('View Display Error', 'Check for error text on page');
      phantomcss.screenshot('div.DashboardPageContentDiv','GCBC Dashboard page 1');
    })
  })
});
```

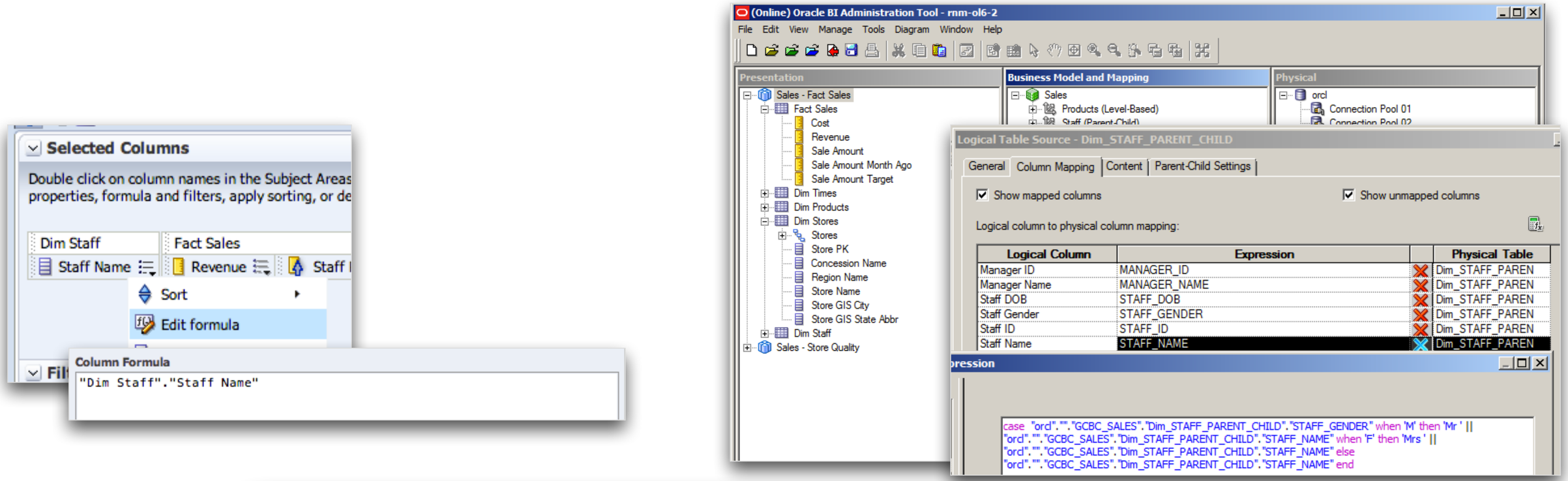
Visual Regression Testing In Action





1. Tool takes automatic snapshot of dashboard pages. This is the baseline.

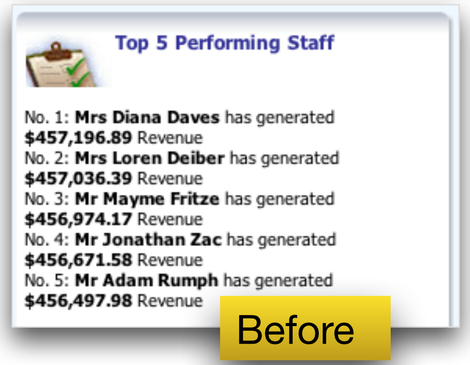
Visual Regression Testing In Action

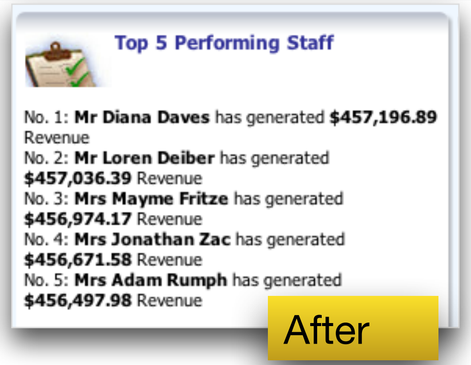


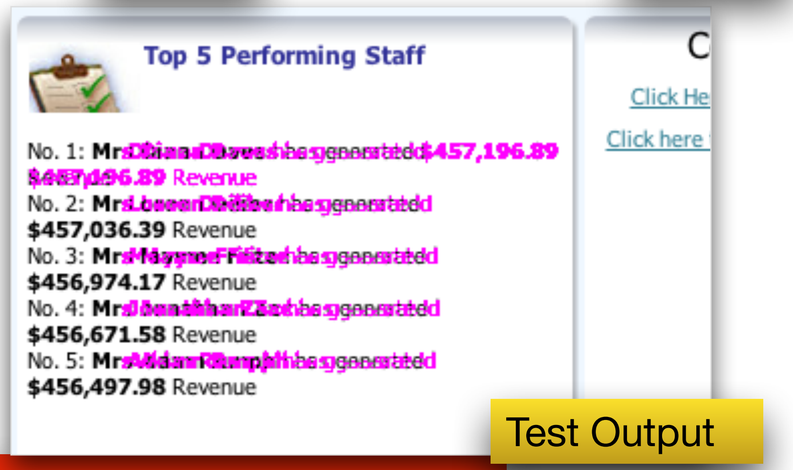
2. Make Analysis/RPD changes

Visual Regression Testing In Action

```
PASS No changes found for screenshot ./phantomcss_screenshots/Dashboard list_1.png
Failure! Saved to ./phantomcss_failures/GCBC Dashboard page 1_2.1.fail.png


FAIL Visual change found for screenshot ./phantomcss_screenshots/GCBC Dashboard page 1_2.png (0.77% mismatch)
#    type: fail
#    file: obiee_phantomcss.js
#    subject: false


PASS No changes found for screenshot ./phantomcss_screenshots/GCBC Dashboard page 2_3.png


PASS No changes found for screenshot ./phantomcss_screenshots/Logged out_4.png


PASS No changes found for screenshot ./phantomcss_screenshots/Login page_0.png

PhantomCSS found 5 tests, 1 of them failed.

PhantomCSS has created some images that try to show the difference (in the directory ./phantomcss_failures). F
FAIL 9 tests executed in 7.341s, 8 passed, 1 failed, 0 dubious, 0 skipped.
```







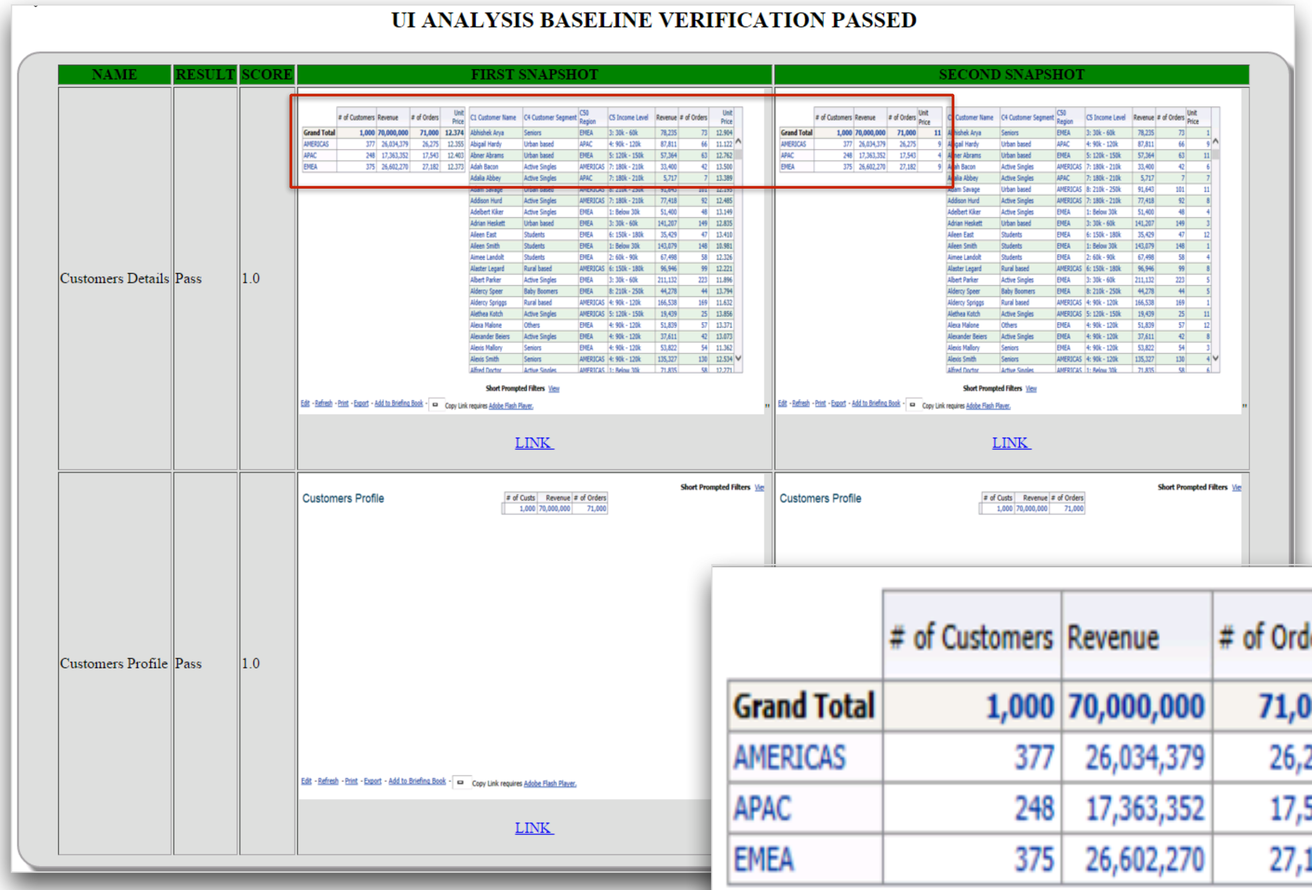
3. Tool captures new screenshots and compares against baseline. Any differences are reported.

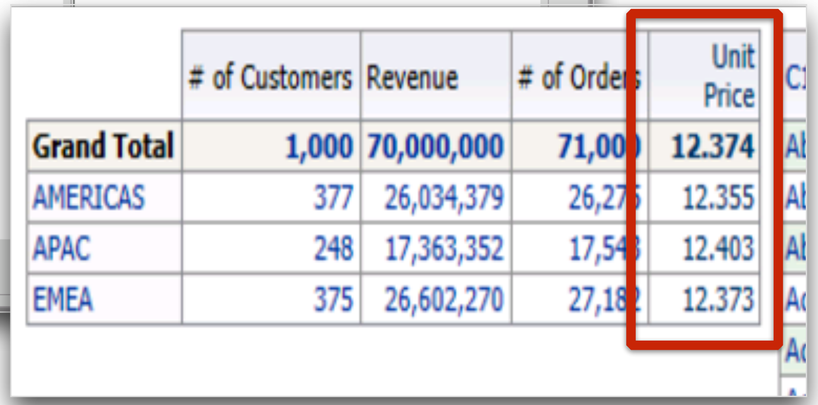
Baseline Validation Tool

- Uses custom code based around Selenium to automagically screenshot each report and dashboard
- Compares resulting images before/after, based on a threshold that can be altered

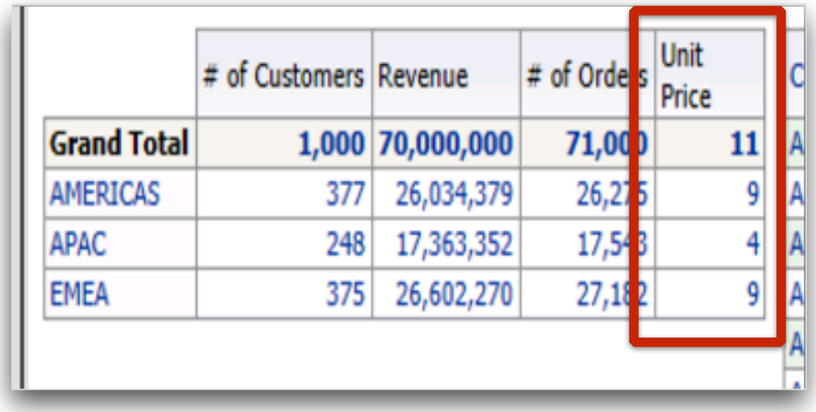
```
<TestPlugin name="com.oracle.biee.bvt.plugin.ui" enabled="true">
        <Parameter name="CatalogRoot" value="/shared/01. QuickStart/Simple Demo Dashboard/Customers"/>
    <!-- how many threads to spawn to load reports, should be greater than 0, less than 50 -->
    <Parameter name="ThreadQueueSize" value="1" />
    <!-- Timeout for loading each report in MSecs should be between 5 secs and 10 mins -->
    <Parameter name="ThreadTimeout" value="60000" />
    <!-- Which BrowserType to use to load reports, Firefox, InternetExplorer. Leave empty for default b
    <Parameter name="BrowserType" value=""/>
    <Test name="FindNotRenderedComponents" enabled="false">
        <!-- ScoreThreshold should be between 0.00 and 1.00  -->
        <Parameter name="ScoreThreshold" value="0.95"/>
        <Parameter name="DisabledPluginImageTemplate" value=""/>
    </Test>
    <Test name="FindReportSnapshotDifferences" enabled="true">
        <!-- ScoreThreshold should be between 0.00 and 1.00  -->
        <Parameter name="ScoreThreshold" value="0.95"/>
    </Test>
    <Test name="FindDashboardSnapshotDifferences" enabled="true">
        <Parameter name="PromptInputFile" value="DashboardPrompts.txt" />
        <Parameter name="ScoreThreshold" value="0.95"/>
    </Test>
```

Baseline Validation Tool



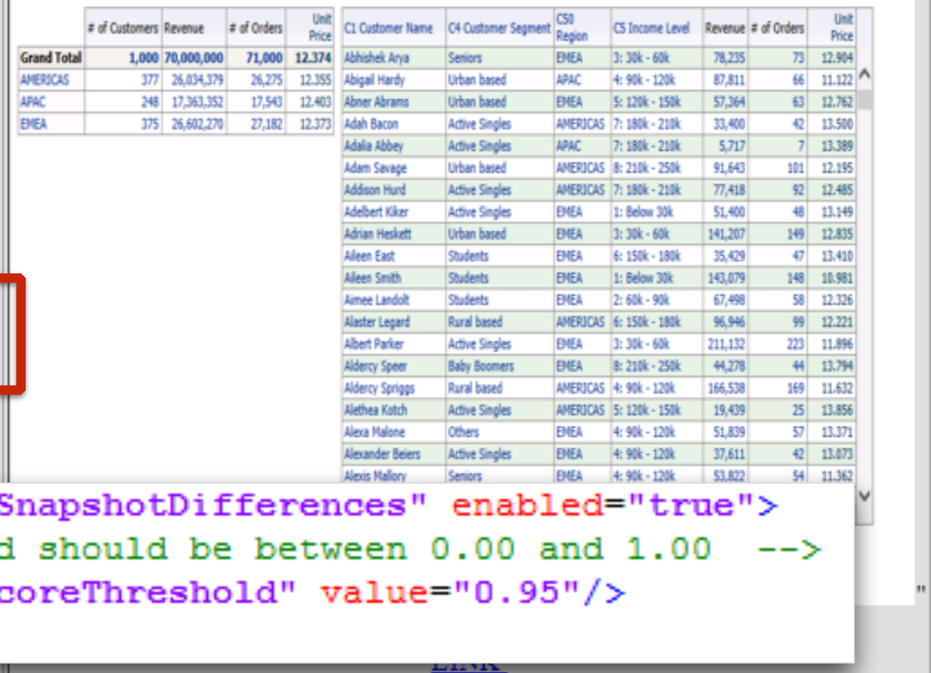


	# of Customers	Revenue	# of Orders	Unit Price
Grand Total	1,000	70,000,000	71,000	12.374
AMERICAS	377	26,034,379	26,275	12.355
APAC	248	17,363,352	17,543	12.403
EMEA	375	26,602,270	27,182	12.373



	# of Customers	Revenue	# of Orders	Unit Price
Grand Total	1,000	70,000,000	71,000	11
AMERICAS	377	26,034,379	26,275	9
APAC	248	17,363,352	17,543	4
EMEA	375	26,602,270	27,182	9

Baseline Validation Tool

NAME	RESULT	SCORE	FIRST SNAPSHOT	SECOND SNAPSHOT
Customers Details	Fail	0.74		

	# of Customers	Revenue	# of Orders	Unit Price
Grand Total	1,000	70,000,000	71,000	12.374
AMERICAS	377	26,034,379	26,275	12.355
APAC	248	17,363,352	17,543	12.403
EMEA	375	26,602,270	27,182	12.373

C1 Customer Name	C4 Customer Segment	C50 Region	C5 Income Level	Revenue	# of Orders	Unit Price
Abhishek Arya	Seniors	EMEA	3: 30k - 60k	78,235	73	12.904
Abigail Hardy	Urban based	APAC	4: 90k - 120k	87,811	66	11.122
Abner Abrams	Urban based	EMEA	5: 120k - 150k	57,364	63	12.762
Adah Bacon	Active Singles	AMERICAS	7: 180k - 210k	33,400	42	13.500
Adalia Abbey	Active Singles	APAC	7: 180k - 210k	5,717	7	13.389
Adam Savage	Urban based	AMERICAS	8: 210k - 250k	91,643	101	12.195
Addison Hurd	Active Singles	AMERICAS	7: 180k - 210k	77,418	92	12.485
Adelbert Kiker	Active Singles	EMEA	1: Below 30k	51,400	48	13.149
Adrian Heskett	Urban based	EMEA	3: 30k - 60k	141,207	149	12.835
Aileen East	Students	EMEA	6: 150k - 180k	35,429	47	13.410
Aileen Smith	Students	EMEA	1: Below 30k	143,079	148	10.981
Aimee Landolt	Students	EMEA	2: 60k - 90k	67,498	58	12.326
Alaster Legard	Rural based	AMERICAS	6: 150k - 180k	96,946	99	12.221
Albert Parker	Active Singles	EMEA	3: 30k - 60k	211,132	223	11.896
Aldercy Speer	Baby Boomers	EMEA	8: 210k - 250k	44,278	44	13.794
Aldercy Spriggs	Rural based	AMERICAS	4: 90k - 120k	166,538	169	11.632
Alethea Kotch	Active Singles	AMERICAS	5: 120k - 150k	19,439	25	13.856
Alexa Malone	Others	EMEA	4: 90k - 120k	51,839	57	13.371
Alexander Beiers	Active Singles	EMEA	4: 90k - 120k	37,611	42	13.073
Alexis Mallory	Seniors	EMEA	4: 90k - 120k	53,822	54	11.362

LINK

	# of Customers	Revenue	# of Orders	Unit Price
Grand Total	1,000	70,000,000	71,000	3
AMERICAS	377	26,034,379	26,275	0
APAC	248	17,363,352	17,543	8
EMEA	375	26,602,270	27,182	1

C50 Region	C5 Income Level	Revenue	# of Orders	Unit Price
EMEA	3: 30k - 60k	78,235	73	7
APAC	4: 90k - 120k	87,811	66	2
EMEA	5: 120k - 150k	57,364	63	2
AMERICAS	7: 180k - 210k	33,400	42	11
APAC	7: 180k - 210k	5,717	7	11
AMERICAS	8: 210k - 250k	91,643	101	3
AMERICAS	7: 180k - 210k	77,418	92	12
EMEA	1: Below 30k	51,400	48	8
EMEA	3: 30k - 60k	141,207	149	7
EMEA	6: 150k - 180k	35,429	47	4
EMEA	1: Below 30k	143,079	148	4
EMEA	2: 60k - 90k	67,498	58	8
AMERICAS	6: 150k - 180k	96,946	99	1
EMEA	3: 30k - 60k	211,132	223	9
EMEA	8: 210k - 250k	44,278	44	10
AMERICAS	4: 90k - 120k	166,538	169	6
AMERICAS	5: 120k - 150k	19,439	25	1
EMEA	4: 90k - 120k	51,839	57	3
EMEA	4: 90k - 120k	37,611	42	0
EMEA	4: 90k - 120k	53,822	54	6
AMERICAS	4: 90k - 120k	135,327	130	9
AMERICAS	1: Below 30k	71,835	58	10

Short Prompted Filters View

Edit - Refresh - Print - Export - Add to Briefing Book - Copy Link requires Adobe Flash Player.

LINK

```
<Test name="FindReportSnapshotDifferences" enabled="true">
    <!-- ScoreThreshold should be between 0.00 and 1.00  -->
    <Parameter name="ScoreThreshold" value="0.95"/>
</Test>
```

Working smarter - summary

Test / *What Changed?*	*Physical*	*Logical*	*Front End*
Report / Dashboard	***No***	***No***	***Yes***
RPD	***No***	***Yes***	***Yes***
Database	***Yes***	***Yes***	***Yes***

#EOF

Rittman Mead
User Engagement Service
http://ritt.md/ue

Rittman Mead
Performance Analytics Service
http://ritt.md/pa

email

robin@rittmanmead.com

web

http://ritt.md/rmoff

twitter

@rmoff

irc

rmoff @ #obihackers